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CONCEPT DEFINITION FOR ELECTRIC MOTOR ASSET MANAGEMENT SERVICE

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ABSTRACT

Jaakko Joukio: Concept definition for electric motor asset management service
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Industrial servitization occurs when industrial manufacturers move from traditional product-based business models towards offerings in which the physical products are offered as parts of wider customer solutions that include services. Digitalization and leaps in industrial product development, as well as positive influences from other sectors, have boosted the development of industrial servitization and a growing interest has emerged from various industrial manufacturing sectors to seek growth and profit generation through service business development.

As a result of servitization development, industrial manufacturers have ended in situations in which driving factors supporting the strategic decisions have not been available or have been contradictory depending on the source. This thesis studied the driving and preventing factors that industrial manufacturers must consider before moving towards service-oriented business models. It was conducted by comparing identified drivers and barriers with actualized positive and negative effects. This produced a validated list of drivers and barriers with corresponding actualized effects from real business cases. Furthermore, this thesis defined an electric motor asset management service concept for the Case Company. The research was conducted as a qualitative panel interview case study. External customer company contacts and internal Case Company contacts provided data of the features with the highest supplier and customer value generation potentials. That information was used to define the most important features that an asset management service should include.

The results showed that various financial development, enhanced customer relationships and increased process-efficiency-related positive effects have been achieved through industrial servitization. To the same extent, the results clearly showed that organizational unpreparedness towards the requirements of servitization implementation has led to offering-related problems which have eventually caused financial problems and even increased bankruptcy risks. Identifying these three steps leading to problems and therefore improving the readiness to resolve them can be regarded as some of this study's most important results. Regarding the asset management service concept, a simple pricing model, straightforward order-delivery process, usage of a 3rd party ownership holder and asset labeling and storage optimization were identified as features holding the highest customer and supplier value generation potential. A need for further research towards especially service strategy implementation processes, ownership options of industrial process-running assets and asset management service triad liability distribution was noticed.

Keywords: Industrial servitization, asset management, industrial service business, electric motor
The originality of this thesis has been checked using the Turnitin OriginalityCheck service.

TIIVISTELMÄ

Jaakko Joukio: Sähkömoottoreiden laitehallintapalvelukonseptin määrittely
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Teollisella palvelullistumisella tarkoitetaan ilmiötä, jossa teolliset laitevalmistajat siirtyvät perinteisistä tuoteperusteisista liiketoimintamalleista kohti tarjoomia, joissa fyysisiä tuotteita tarjotaan osana laajempaa, palvelujakin sisältävää asiakasratkaisua. Digitalisaatio ja teollisen tuotekehityksen harppaukset sekä muiden sektoreiden myönteiset vaikutukset ovat tehostaneet teollista palvellistumiskehitystä ja valmistavan teollisuuden eri sektorit ovat kasvua ja tuloskehitystä etsiessään osoittaneet kasvavaa kiinnostusta palveluliiketoiminnan kehittämistä kohtaan.

Palvelullistumiskehityksen myötä teolliset valmistajat ovat ajautuneet tilanteisiin, joissa muutosajureita strategiapäätösten tueksi ei ole ollut saatavilla tai tieto on ollut eri lähteiden kesken ristiriitaista. Tämä diplomityö tutki muutosajureita ja -esteitä, joita teolliset laitevalmistajat joutuvat ottamaan huomioon ennen palvelupainotteisiin liiketoimintamalleihin siirtymistä. Tutkimus toteutettiin vertailemalla ajureita ja estäjiä, joita vastaavia positiivisia tai negatiivisia vaikutuksia teolliset palvelullistamispäätökset olivat aiemman tutkimuksen perusteella tuottaneet. Vertailu tuotti listan muutosajureista ja -esteistä, joita vastaavia myönteisiä ja kielteisiä vaikutuksia aiemmin toteutetut palvelullistumisprojektit olivat todellisille valmistavan teollisuuden yrityksille tuottaneet. Muutosajureiden ja -esteiden lisäksi tässä diplomityössä määriteltiin kohdeyritykselle runko tärkeimmistä ominaisuuksista, joita sähkömoottoreiden laitehallintapalvelukonseptin tulisi sisältää mahdollisimman korkean toimittaja- ja asiakasarvon tuottamista varten. Tutkimus toteutettiin laadullisena tapaustutkimuksena paneelidata-analyysin avulla. Asiakaskontakteja ja kohdeyrityksen sisäisiä kontakteja haastateltiin haastattelurunkojen avulla laitehallintapalvelukonseptin ominaisuuksista, joita he pitivät tärkeimpinä arvontuottajina omasta näkökulmastaan. Tätä dataa käytettiin laitehallintapalvelun tärkeimpien ominaisuuksien määrittelyssä.

Tulokset osoittivat, että teollisella palvelullistumisella on saavutettu useita tuloksentekokyvyn kehittämiseen, asiakassuhteiden parantamiseen ja prosessien tehokkuuden kasvattamiseen liittyviä positiivisia vaikutuksia. Vastaavasti tulokset osoittivat selkeästi, että organisaatiotason valmistautumattomuus palvelullistamisen toimeenpanoa varten on johtanut erilaisiin tarjoomahaasteisiin, jotka osaltaan ovat johtaneet taloudellisiin ongelmiin. Näiden kolmen ongelmiin johtavan askeleen tunnistamista ja siten niiden ratkaisuvalmiuden parantamista voidaan pitää eräinä tämän diplomityön keskeisimmistä tutkimustuloksista. Laitehallintapalvelukonseptin tärkeimpien ominaisuuksien rungoksi osoittautui yksinkertaisen hinnoittelumallin, ulkoisen omistajaosapuolen sekä sähkömoottoreiden nimike- ja varastointimäärien optimoinnin muodostama kokonaisuus. Tieteellisen lisätutkimuksen kohteiksi tämä diplomityö osoitti palvelullistamisstrategian käyttöönottoprosessiin, omistajaosapuolivaihtoehtoihin sekä palvelutriadin vastuunjakoon liittyviä aihealueita.

Avainsanat: teollinen palvelullistuminen, laitehallinta, teollinen palveluliiketoiminta, sähkömoottori
Tämän julkaisun alkuperäisyys on tarkastettu Turnitin OriginalityCheck –ohjelmalla.

PREFACE

The past five and a half years in Tampere University of Technology have formed the most memorable journey of my life so far. With the moment of graduation now looming nearby, so is that journey also coming to an end. There are plenty of people to whom I owe my gratitude for these past years and with whom I have had the privilege to share the ups and downs along the way.

First, I want to thank my examiner Miia for offering her support whenever I needed some. Her precious help made me overcome the obstacles on the way and hold on to my graduation schedule. I want to thank Antti for supervising this thesis and especially for becoming a great friend during this past year. I also want to thank Kalle for offering his knowledge and contacts for this thesis and providing flesh on the bones of the empirical part. Furthermore, I want to thank the people who participated in the interviews and the Case Company for offering an intriguing subject for my thesis.

To my friends around the campus, I owe you my sincerest gratitude for these past years. This journey has taught me the meaning of true friendship better than I could ever have imagined. That sense of belonging I will be missing the most.

I also want to express special gratitude and appreciation to my parents for providing me an ambitious and supportive environment to grow up. Your example has pushed me to reach this moment.

And last, I want to thank you, Petra, for your support.
Our journey is just beginning.

Helsinki, 12.12.2019

Jaakko Joukio

CONTENTS

ABBREVIATIONS

AMS	Asset Management Service
IAS	International Accounting Standard
IASB	International Accounting Standards Board
IoT	Internet of Things
IIoT	Industrial Internet of Things
Lessee	User of an asset
Lessor	Owner of an asset
POPSS	Product-oriented product-service-systems
PSS(s)	Product-service-system(s)
ROPPS	Result-oriented product-service-systems
UOPPS	Use-oriented product-service-systems

1. INTRODUCTION

During the 2010s, novel technologies, development of the old ones and increased market competition have pushed manufacturers to modify their product-based business models closer to service-based solutions. This has liberalized for example the way asset ownership can be reshaped and has challenged manufacturers to create offerings with lower investment decision and risk management levels for the customers. According to Cherry and Pidgeon (2018), pay-per-use type of services without transferred ownership decreases customer's problems that come along with the ownership itself and can also increase the longevity of the physical assets. Regardless of the industry, ownership-related questions can be seen as key characteristics of a service-oriented business. This study is focused on the asset management perspective of industrial electric motors.

1.1 Background

Common perception of usage and management questions of physical industrial assets has been changing during the current decade. These options for physical products have increased since fast-moving business environments have pushed old and new market actors to reshape their product-based sales and operations towards service-based, customer-tailored solutions. The evolution of industrial manufacturing business models from product- to service-based solutions is called **servitization.** It is used to describe the global trend of business development from product deliveries to integrated solution offerings in which services play a big part. (Vandermerwe & Rada 1988, cited in Vendrell-Herreroa et al. 2017; Rabetino et al. 2017; Kujala et al. 2011).

On the consumer market side, *Netflix* and *Apple* can be used as examples of long-term track record holders for business reformation from product sales towards service solution offerings. *Netflix*, along with other global streaming services and smart television development, practically erased the markets of physical DVD/Blu-ray copies and separate media players by enabling users to select, pay and play movies and TV shows without leaving their homes. Even after the breakthrough, the company's paying subscriber amount has still increased for example by 25.1% (29.96M) between Q1/2018 and Q1/2019 (Netflix, Inc. 2019). *Apple,* on the other hand, has been able to compensate

the decreased product sales of e.g. iPhone and Mac by increasing its service segment revenue by over 30% ($9.55B) between Q3/2017 and Q3/2018 (Apple, Inc. 2018).

The development towards servitization can now be seen to have gradually taken its place on a variety of industrial market segments, where asset manufacturers have shifted their focuses towards solution deliverance instead of offering separate products as parts of the customers' solutions. Due to the high values of the assets and their high-value roles in customer production processes, the consensus on global electric motor markets has been to transfer the ownership of the assets to the customer and therefore remain disconnected from the trend of servitization. Transferring the ownership lowers the risks and responsibilities of the manufacturer but also narrows the business model and profit-generating possibilities. Helander and Möller (2007) have also pointed out that some customers only allow pure supplier roles for external operators and prefer to remain independent from the manufacturer's actions. It can also be stated that the manufacturer is a relevant asset provider and a business partner only for the customers who fully rely on the expertise and reliability of the manufacturer (Davies 2004). Due to these reasons, the options for asset management have remained limited and the electric motor manufacturers still base their revenue generation on traditional asset sales on top of which the service business is conducted in form of e.g. maintenance or condition monitoring.

This thesis aims to define an asset management service concept for industrial electric motors. It is conducted by examining the features of an asset management service that contain the most value for both the customers and the supplier.

1.2 Research context

This thesis examines electric motors as industrial process-running assets and is concentrated on the manufacturing industry as the customer field. To enable efficient structuring of the study and to ease aggregation of the findings, the asset management service is defined on a concept level to act as a basis for further research. The observation level of the study includes electric motor manufacturers as motor suppliers and motor customers. Possibility for a service triad including a 3rd party ownership holder is also noted. Standpoint is aimed towards economical analysis instead of technological details.

The Case Company used in the empirical part of the thesis is a subsidiary of a globally operating multi-field technology company with an annual revenue of 25 billion euros (2018). The company offers a wide range of electric motors and other high-level electric power, generation and transportation solutions for both industrial and private markets. The service portfolio of the company is also considerably widely varied. On the electric motor side, it has shifted the focus from products to solutions during the recent years and therefore represents the phenomenon described at the beginning of this chapter about servitization.

1.3 Research objectives and questions

This study's subject circulates around the servitization of industrial electric motors. The study's objective is to detect industrial servitization drivers and barriers from the supplier's point of view and define value generative features of an asset management service offering. Based on the findings, a statement for an asset management service concept definition is formed through three core values that the supplier should take into account during the offering design process.

In an ideal case, the results and findings of this study could be used to support the decisions and actions leading towards the creation and usage of an electric motor asset management service and further support the development of other industrial service solution offerings. The outcome of the study also aims to describe and analyze the effects of industrial servitization from both driving and preventing points of view by comparing identified drivers and barriers to actualized effects from earlier literature. To ensure correct focusing, this thesis pursues to find answers for the following research questions:

Research question 1:
What factors drive or prevent industrial manufacturers to transform their business models towards servitized solution offerings?

Research question 2:
As part of a business model used to servitize industrial electric motors, what features should an asset management service concept include in order to create maximum customer and supplier value?

The focus of this study is on the industrial, B2B (business-to-business) environment between industrial manufacturers and industrial end-customers. The selected manufacturing industry context differs from consumer applications and even though some results could be partly applicable to B2C (business-to-consumer) context also, the findings are presented purely from an industrial point of view.

1.4 Structure

This thesis is divided into six chapters; introduction, literature review, methodology, results, analysis, and conclusions. Central concepts such as *asset*, *servitization* and *service concept* are described at the beginning of the literature review to assist reader's understanding of the wider topic areas. Further in the literature review, the concepts and research questions are observed closer and scoped through existing research and literature data. Drivers and barriers affecting industrial manufacturers' decisions to move towards or withhold from strategy decisions leading to servitization are examined as well as the actualized effects of the made servitization decisions. To provide the reader with an overview of industrial service business including physical assets, different established business models categories are presented. Due to the subject of service business and servitization towards physical process-running assets, different options for the ownership of these assets are also presented. At the end of the literature review, gathered information related to the research questions is summarized. The content of the literature review is used later to support the empirical part of the study.

The empirical part of the thesis begins with the third chapter, which presents the used research methodology. Research design and the Case Company of the study are presented as well as the used data collection and processing methods. Justification processes behind different research and concept definition related decisions are also described as well as a brief overview of the electric motors and their usage as the subject of the asset management service under definition. The fourth chapter holds the results of the empirical study. Pre-decision influencers and actualized effects of industrial servitization are compared together to show the drivers and barriers which have also concretised in real cases. Features of an asset management service that would create the maximum value generative potential for both the supplier and the customers are presented and a statement describing the core features which the asset management service should eventually include is stated.

Final chapters include discussion and reflection of the results towards earlier research, an action plan for the Case Company, academic and managerial contributions, evaluation and limitations of the empirical study and proposable subjects for future research.

2. LITERATURE REVIEW

The purpose of the chapter is to provide the reader with an overview of industrial servitization and earlier research regarding the topics of this study. Observation of the subject begins by defining central concepts and on how those they have been used later in this study. The observation then turns towards the researched general effects of service-oriented strategy transformations by industrial manufacturing companies and the driving and preventing factors behind the global trend of industrial servitization. The effects are introduced from dyadic points of view, referring to conducted observation from both the manufacturer's and the customer's side. Industry-specific results from earlier research are presented and wider environmental and societal effects of global service development are also briefly addressed. After that, the focus is shifted towards the practical service business models that have been examined and brought up in earlier research of industrial service business. An established categorization model is introduced and background for servitized industrial offering business models is addressed. In the end, the chapter is summoned and a synthesis of the available and unavailable information is presented. Critique and questioning of specific research evidence and conclusions by other scholars are also conducted.

2.1 Central concepts

To clarify and generate a basic view for the reader of industrial servitization and the offerings it creates and enables, this chapter explains some of the general to be used later in this study. To clarify the structure and entities, the chapter is divided into two sections. The first part addresses main knowledge regarding servitization as a phenomenon, industrial asset manufacturing business, and industrial service offerings. The second part then widens the perspective of observation towards the fundamentals and requirements of industrial service business, industrial service business models and actors in the industrial service business value chains. Central terms such as asset, manufacturer and customer are introduced before the two individual chapters to allow a clear understanding of the latter terms.

Asset as a broad term stands for any tangible or intangible capital of a company. *International Financial Reporting Standards Foundation (IFRS Foundation)* and *International Accounting Standards Board (IASB)* have defined tangible assets, also known as *fixed assets* or *properties, plants and equipment (PP&E),* as follows:

"***Property, plant and equipment are tangible items that:***

- *are held for use in the production or supply of goods or services, for rental to others, or for administrative purposes; and*
- *are expected to be used during more than one period.*

The cost of an item of property, plant and equipment is recognised as an asset if, and only if:

- *it is probable that future economic benefits associated with the item will flow to the entity; and*
- *the cost of the item can be measured reliably.*" (IFRS, 2014.)"

European Union (EU) imposed an application of IFRS/IAS standards to all EU listed companies in 2005 after which other countries have also more or less followed the same standards. An exception to this has been the United States and its own *Generally Accepted Accounting Principles (GAAP)* but in the context of this study, the IFRS/IAS definition is used and generalized to cover the global asset markets (HelaTurki et al. 2017).

Fixed assets for industrial manufacturing companies typically include land, factories, buildings, machines and other equipment, such as electric motors that power the functions of the factory. Intangible assets consist of cash, other deposits and different forms of standardized know-how, such as company-held patents and trademarks. Personnel skills and experience can also be seen as intangible assets, but due to the impossibility of standardization or licensing, they are not noted as actual company assets. From an accounting point of view, assets are noted on the company's balance sheet as counterparts for liabilities and shareholder equity. For clarity reasons, this study uses the term *asset* without a prefix when referring to industrial process equipment, such as electric motors.

The principal term used in this study to indicate the party providing and selling assets is **supplier**. It is chosen due to the nature of industrial business which this study mainly observes. Electric motors as assets are typically sold directly without third party suppliers between manufacturers and customers. However, alternative options *manufacturer* and *provider* are also used now and then depending on the context. The term **customer** is used in this study to define the party which buys and utilizes assets produced and sold by the suppliers.

2.1.1 Servitization and service-related offerings

Offering as a term is used to indicate a good, service or combination, which is offered to the company's customers. Traditional industrial offerings vary between assets and services with assets referring to a physical goods, machines or other equipment and services referring to all services sold on top of the asset itself or separately without particular asset sales. (Tukker 2004; Lindahl et al. 2014.)

Servitization stands for a strategy transition phenomenon, in which a manufacturer adopts a service-oriented business model and moves its strategy towards servitized offerings. It shifts the focus from *service as a side product* towards *service as a solution*. As an acknowledged trend, servitization was first introduced by Vandermerwe and Rada in the late 1980s. In that scientific publication commonly seen as the first definition of servitization, the authors pointed out three main drivers created by servitization (Neely 2008):

1. *Locking out competitors*
2. *Locking in customers*
3. *Increasing the level of differentiation*

As the servitization trend has evolved during the recent period of rapid smart system and IoT development, some more recent definitions of servitization have been addressed on various researches and are presented in Table 1.

Table 1. *Definitions of servitization*

Author	Definition
Vandermerve & Rada 1988 (According to Maheepala et al. 2016)	"The increased offering of fuller market packages or 'bundles' of customer focused combinations of goods, services, support, self-service and knowledge in order to add value to core product offerings."
Neely 2008	"Servitization involves the innovation of an organization's capabilities and processes so that it can better create mutual value through a shift from selling product to selling Product-Service Systems."
Baines 2009	"Servitization is the innovation of an organization's capabilities and processes to better create mutual value through a shift from selling product to selling PSS."
Kowalkowski et al. 2017	"The transformational processes whereby a company shifts from a product-centric to a service-centric business model and logic."

Addressing the servitization of manufacturing companies is essential for this study since the empirical part aims to outline an asset management service which can be seen as a clear example of servitization conducted towards industrial electric motors.

Product-Service-System (PSS) can be defined as an integrated product and service offering. PSSs are practical outcomes of servitization, valuing asset performance and utilization over ownership. PSSs are integrated combinations of products and services forming marketable packages capable of fulfilling user needs. (Goedkoop et al. 1999, cited in Mont 2002; Baines 2007.) The term emphasizes delivery of usage and availability instead of physical product sales. It integrates services with the manufactured asset, creating solutions containing a function-providing outcome of the asset as part of the offering. This extends the traditional use and functionalities of the product itself (Baines et al. 2007, p. 1). PSSs are categorized in numerous ways but the most common categorization with three main categories and eight sub-categories has been introduced by Tukker in 2004. Tukker's categorization model is presented more thoroughly in chapter 2.3.1. Some earlier research definitions of PSS are presented in Table 2.

Table 2. *Definitions of Product-Service-System*

Author	Definition
Mont, 2002	"A PSS should be defined as a system of products, services, supporting networks and infrastructure that is designed to be: competitive, satisfy customer needs and have a lower environmental impact than traditional business models."
Tukker, 2004	"Tangible products and intangible services designed and combined so that they jointly are capable of fulfilling specific customer needs."
Baines et al., 2007	"A PSS is an integrated product and service offering that delivers value in use. A PSS offers the opportunity to decouple economic success from material consumption and hence reduce the environmental impact of economic activity."
Neely, 2008	"Integrated product and service offering producing customer value in use."
Tekes, 2010	"Standardized and documented products based on services."

For this study, the selection to use *Product-Service-System* as the defining concept for the types of offerings observed is made based on the nature of industrial product-based services and PSS definitions by other authors presented in Table 2. Scholars often describe the servitization transition specifically through PSS offerings which also supports the selection. Earlier research and scientific interest towards PSSs in general has also rapidly progressed and the number of annually published PSS research papers more than quadrupled between 2005-2015 (Tukker 2015). Other resembling terms and possible alternatives for this study are presented below in Table 3 with their definitions.

Table 3. *Alternative terms for Product-Service-System*

Author	Term	Definition
Brax & Jonsson 2009	*Integrated solutions*	"Complex and customized offerings that extend beyond mere bundles of services and products. These solutions can create value by improving operating efficiency, increasing asset effectiveness, enabling market expansion and mitigating risk."
Dustdar 2009	*Complex service-oriented system*	"Highly dynamic systems comprising humans and software services and spanning multiple organizations. Not only services, processes and teams are diverse, but they also constantly evolve."
Ulaga & Reinartz 2011	*Hybrid offerings*	"Combination of one or more goods and one or more services, creating more customer benefits than if the good and service were available separately."
Baines & Lightfoot 2014	*Advanced services*	"Manufacturer delivered services that are critical for their customers' core business processes, coupled with incentivized contracting mechanism. E.g. availability contracting and risk and revenue sharing."

Figure 1 represents the core difference between an asset-service combination and a product-service-system. With PSSs, the customer is offered a single package instead of separate assets and service components.

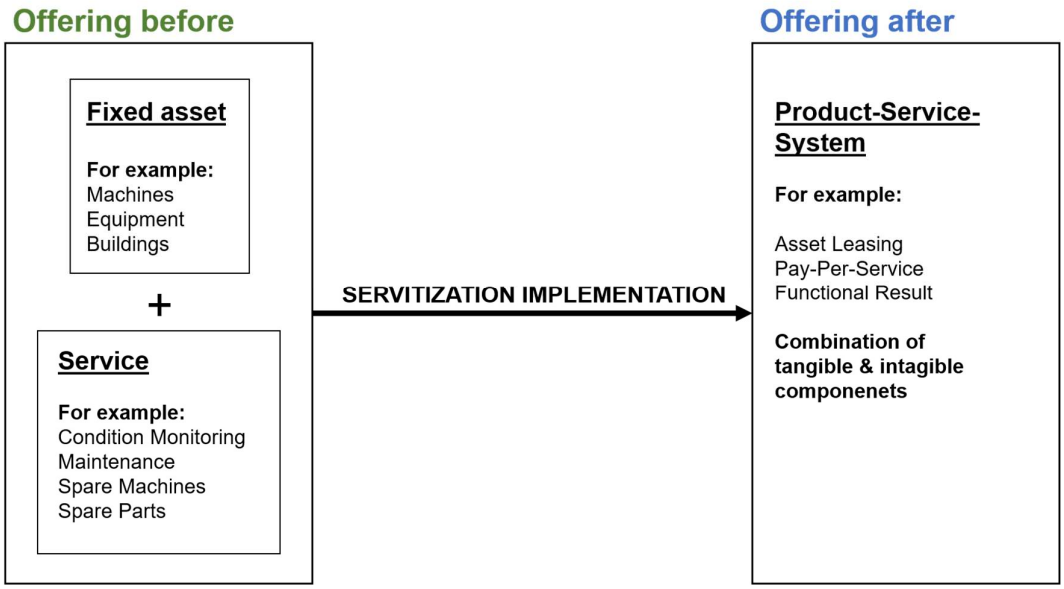

Figure 1. *Offering development from a combination of products and services towards a solution offering*

2.1.2 Service-oriented business

Service concept is defined in various ways and the definition has also depended on the definer. In general, it can be seen as a "customer benefit package", that answers the customer's question "What is the gained value from this solution?" (Marcum 1994). It defines the core customer needs, how they are planned to be fulfilled and what organizational matters do they require (Martinsuo et al. 2018). Tekes (since then *Business Finland*) has defined service concept as a "description and operating principle of a service idea to fulfill the service offering". As the foundation of any service supplier's business, the service concept has to include a revenue model and a conception of the central features, customer value generators and required resources of the service. (Tekes 2010.) The value chain that is obliged for the service concept to operate and function as a customer value generator is described by the business model of the service. Clarifying the service concept is therefore crucial for the formation of the business model itself. In a way, service concept can be seen as a vision that the service provider is pursuing regarding the offerings and value generated for the customers by those offering models.

Regarding this study, asset management is a considerable element of any service concept that includes PSS offerings. Asset management describes the ownership, maintenance and other asset-related requirements that the supplier has to take into

account while developing the business model. Ownership of the physical equipment assets is a core question regarding industrial PSS business models since manufacturing equipment can represent a significant portion of the customer's fixed asset base due to their generally high unit value. The reason of existence for all assets is the ability to increase value generation and benefit the firm's operations (IFRS 2014). Together with digitalization, IoT and servitization drivers presented in chapter 2.2.1, this has started development in asset ownership strategies. External researchers, as well as manufacturing companies and their customers, have conducted increasing amounts of re-evaluation towards traditional business models and the actual pros and cons of customer's fixed asset ownership. As a result, global industrial evolution towards servitized business models has emerged. Ownership of industrial assets is addressed more thoroughly in chapter 2.3.2.

Business model is a description of the service concept's value proposition, value chain that the service concept's execution requires and a presentation of the earning possibilities that it creates (Martinsuo et al. 2018). It describes the rationale of how an organization creates, delivers, and captures customer value and is firmly built around the service concept (Osterwalder & Pigneur 2010). A business model basically represents the needs and requirements that the service concept's realization demands. According to the well-established Business Model Canvas concept, any business model can be divided into 9 key components presented in Table 4. All of the key components are named on the left column and the questions which they aim to answer regarding the business model creation are presented on the right column.

Table 4. *Key components of the Business Model Canvas (Osterwalder & Pigneur 2010)*

Key component	Strategic questions to which the component answers to
1. Customer segments	*For whom is the company creating value?* *Who are the most important customers/customer groups?*
2. Value propositions	*What value does the company deliver to the customers?* *What customer problems is the offering solving?* *Which customer needs are satisfied?*
3. Channels	*Which channels does the Customer Segments want to be reached through?* *How are the customers reached at the moment?* *How are the company's communication, distribution and sales channels integrated?*
4. Customer relationships	*What types of relationships are the Customer Segments expecting to be established and maintained?* *How are the Customer Relationships integrated with the rest of the business model?*
5. Revenue streams	*What value are the customers actually willing to pay for and for what are they currently paying?* *How much does each Revenue Stream contribute to the overall revenues?* *What kind of pricing model would be the most effective; fixed, dynamic, something else?*
6. Key resources	*What resources does the company's Value Propositions require?*
7. Key activities	*What activities does the company's Value Propositions require?*
8. Key partnerships	*Who are the company's key partners and suppliers?* *Which of the Key Activities are the partners performing?* *Which Key Resources is the company acquiring from partners?*
9. Cost structure	*What are the most vital costs for our business model?* *Which Key Resources and Key Activities are the most expensive?*

The Business Model Canvas itself (Figure 2) is formed around these key components. The canvas can be used for modeling and forming the demands, requirements and other considerable aspects regarding starting up a new or reforming an existing business. As can be seen from the canvas, the value proposition is the core of any business model since all the other components are designed to support the delivery of the proposed customer value.

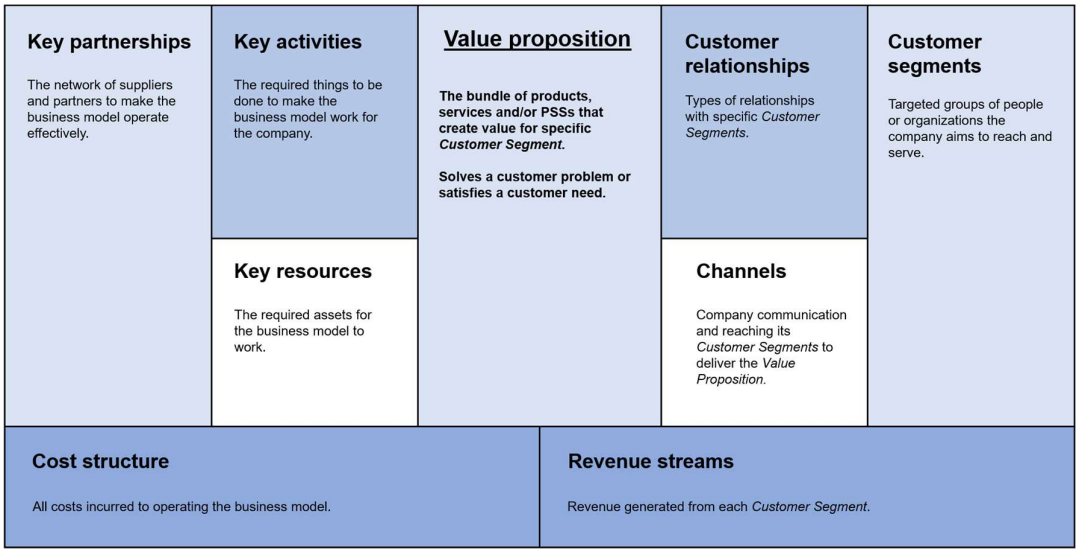

Figure 2. *Business Model Canvas (Osterwalder & Pigneur 2010)*

Service triad can be defined as a depiction of collaboration between three independent market actors. These actors might include for example a service supplier, a service buyer and a customer to whom the service is offered. Together they form a triadic relationship which in theory can be seen as the smallest possible business network. Possible service triad models differ a lot by containing different actors and different levels of business relationships from participatory interaction to contractual regulation. Stable relationships are vital for triads to work effectively and since commercial activities are seen to require progressive attention towards the development of business ecosystems, the significance of these business relationships is clear. Careful consideration of possible confidentiality matters is required since the independent actors might receive insight to the operations of other companies for the triad to function effectively or gain information as a side effect without further purpose. (Martinsuo et al. 2018, p. 86-87.)

Service triads differ from manufacturing triads in regards to the necessity of these business relationships. Due to the suppliers' role in the middle of some manufacturing triads, these triads do not necessarily require communication between component manufacturers and the component end-users. In service triads, this inter-triadic communication is necessary. It can be seen that service triads incorporate the customer as a member of the triad whereas manufacturing triads see the customer as the end-result of cooperation of supplier(s) and buyer. (Wynstra et al. 2015.) As Sampson (2000) states, in service operations also customers have to be seen as suppliers since they

provide the primary need for the service triad's existence. Figure 3 presents a simple model of a service triad with a reserved role for a third party operator.

Third party (3rd party) as a term is used to indicate an actor that is not directly linked to but still has a role in a business operation. Martinsuo et al. (2018) have described third parties as "influencers between service providers and customers even though not being a part of the direct supply chain itself". With commercial markets, the term third party is used to describe for example a supply chain operator between the manufacturer and the customer. In this study, the main focus considering third-parties is how they act between manufacturers (service providers) and customers as ownership operators.

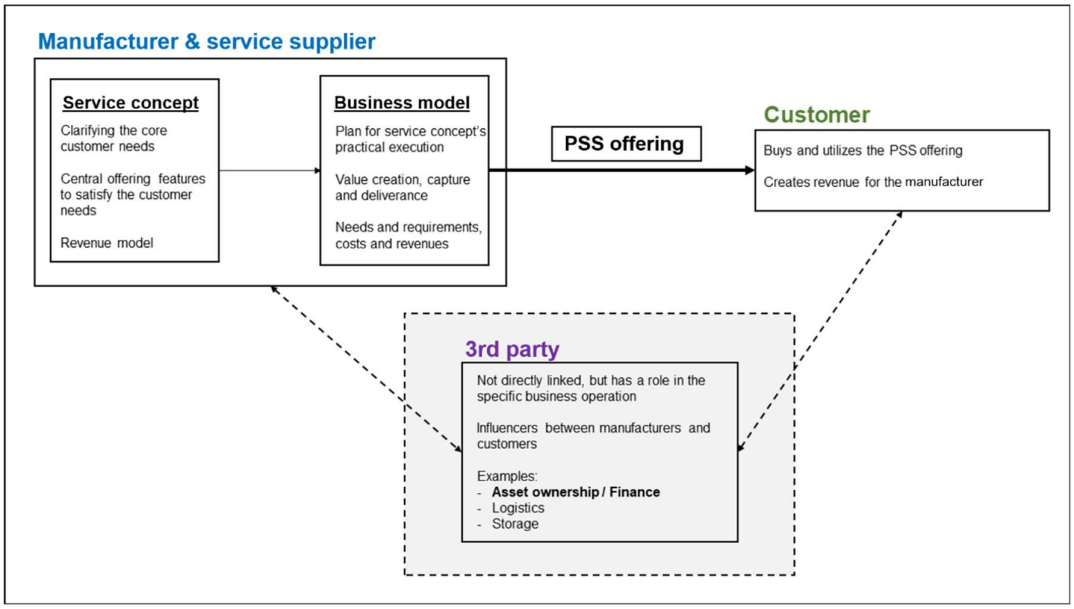

Figure 3. *Example of a service triad*

2.2 Service strategy creation and implementation

The spectrum of traditional products and services offered by manufacturing companies has changed drastically by digitalization and the development of information and communication technologies towards smart systems (Neely 2008; Lenka et. al 2016*)*. Servitization has been widely recognized as the innovation of an organization's capabilities and processes to create value effectively through a shift from selling products to selling solution packages, for example, Product-Service-Systems (Ahamed et al. 2013). As the new service-based offerings have emerged to traditional product markets, the direct differentiation between products and services has become blurred. For this

study, the focus of observation is on solutions where the physical asset is offered to the customer as part of a packaged product-service solution.

During early servitization research, Vandermerwe & Rada (1988, cited in Maheepala et al. 2016) have stated that service development is a key factor for maintaining sustainable and competitive business advantages on product-based markets. Since then, research towards servitization has increased during the 21st century, which has been indicated as growing interest towards service-led competitive strategies by asset manufacturers. Moving towards servitization has been accounted as a choice of strategy to create distinctive value sustainably, which is easier to defend against e.g. lower cost economy competition. (Baines et al. 2009.) Statement of Vandermerwe & Rada (1988, cited in Maheepala et al. 2016) has concretized in form of a global and multi-industrial trend of increased service business development.

While servitization decisions have moved the focus of manufacturers from product-based towards service-oriented business models, the consensus about industrial servitization's unilateral positive effects has decreased. Even though the revenue-increasing effects of servitization are widely recognized, they do not always coincide with actually increased profits. According to Annarelli et al. (2019), the provision of PSS offerings is found to often increase the company's fixed costs and together with some common complexities, the end-result might, as a matter of fact, erode the actual profits making the strategy transformation counterproductive. This increased amount of both driving and preventing arguments has formed a situation commonly known as **service paradox** (Kowalkowski et al. 2017).

2.2.1 Servitization drivers

Drivers directing industrial manufacturers towards servitization strategies have been widely researched on the course of the 21st century. Tukker (2004) has first presented the following arguments to be considered as the foundation for servitization strategy implementation decisions.

1. *What is the **market value** of the PSS?*
2. *What are the **production costs** of the PSS?*
3. *What are the **investment/capital needs** for PSS production?*
4. *How will the **value capturing abilities** present themselves in the value chain, now and in the future?*

One major emphasizer for after-sales service business has been the extended life-cycles of industrially manufactured assets and the by-effects of that development. Wise and Baumgartner have addressed already in 1999, that the installed-base-to-new-unit ratios of industrially manufactured products varied from 13:1 with cars to 150:1 with aircrafts. The ratio represents the number of already operative units for every new unit sold. Due to those kinds of market structures, it has been seen as a clear business necessity (Neely 2008) for the manufacturers and suppliers to also concentrate on the service of the existing base of products, instead of pure development and sales of new ones.

Neely (2008) presents a case of aircraft engine manufacturers offering PSS packages for airlines containing the deliverance of engine capability power-by-the-hour (R2/R3), instead of selling the engines as assets themselves. This results to a business phenomenon where even though the customers receive these physical assets to power and enable their core functions, the business model of the motor manufacturer is not based on the physical asset sales but on to the capability, in Neely's case aircraft engine power, delivered by those products. These kinds of PSS business models utilize the manufacturing company's physical products and allow a service solution to be built around them. In addition to the life-cycle resulted motivators, earlier research findings regarding other drivers of servitization are presented in Table 5.

Table 5. *Servitization drivers*

Author	Industry	Methodology	Drivers
Mont 2002	General	Analysis of earlier research	Appropriate responding to customer demands Increased customer relationships and customer retention Improved competitiveness through improved environmental performance
Baines et al. 2007	General	Literature review	High-value offerings that are easily differentiated Released ownership responsibilities from the customer Increased generated value through customization and quality improvements
di Serio et al. 2017	Heavy trucks	Case study Qualitative data collection: Semi-structured interviews with company executives Document analysis	Differentiation Substitution avoidance Increased customer dependence and loyalty Financial motivation from increased service sales Maintaining a more constant and predictable flow of revenues Stimulating repetitive purchases

Author	Industry	Methodology	Drivers
Correa, 2018	General	Analysis of earlier research	Difficulty for competitors to copy and "reverse engineer" the services Customer retention and therefore higher profitability due to service contracts with a duration Lesser commoditization compared to products Turning customers' fixed costs to variable costs Ability for customers to focus on their core competencies
Doni et al., 2019	Manufacturing	Bloomberg ESG database analysis	Increasing profit margins and revenues Increasing sales Improving relationships leading to customer "lock-ins"

Based on the presented research findings, it is clear that the companies are seeking strategic, financial and marketing related benefits from the PSS implementation decisions. The most conjunctive factors behind companies' PSS implementation schemes can be concluded to three main drivers:

- **Increasing generated customer value** through differentiation possibilities
- **Tightening customer relationships** through more frequent interactions
- **Maintaining and increasing revenue streams** through increased sales

These drivers are distinctively close to the ones presented in chapter 2.1.1 (Vandermerwe & Rada 1988, cited in Neely 2008). In all cases, it is easy to draw a conclusion that without exceptions, the influencers behind companies' servitization decisions are on some level customer-oriented. Customer perspective's significance in increasingly competitive business environments has gradually increased as market area growth has forced manufacturers to outrun an increasing number of competitors. This phenomenon acts as an indicator for the ongoing global manufacturing market reformation, where the classic differentiation strategies based on bare product innovations or technological empowerment no more provide the desired business sustainability. This has made the differentiation based on products and prices become less significant (Ulaga & Reinartz 2011) and some sources have directly presented PSS strategies as a necessity for manufacturing companies from developed market areas due to the impossibility of price competition against low-cost economies. (Baines et al. 2009c.) Servitization can therefore be considered as a step of natural business evolution for traditional manufacturers to survive under the heavy price competition subjected by emerging markets, such as China or India.

When electric motors as PSS offerings are considered, a cross-sectional analysis of earlier research results conducted by Neely et al. (2011, p. 11) concludes that "no evidence that firms in the **electronic and other electrical equipment and components industry** experience better or worse financial performance by servitizing". Despite these arguments, the results can be seen as partially expired due to the progress of digitalization during the time passed since 2011. As the definition does not directly match with electric motors, a critical and more thorough reobservation is also required. As an incentive, contradicting findings of supporting and objecting factors of PSS investments by more recent research are presented in Table 6 (Jovanovic et al. 2016). The factors considering electric motors as process-running assets are **bolded** to indicate the emphasis on the supporting side of the table.

Table 6. *Factors influencing PSS implementation decisions (Jovanovic et al. 2016)*

Supporting	Objecting
High value in customer's process	Asset operated outdoors
Not part of customer's core business	Varying operators
Higher costs of repairing than preventing	Specific and indirect sales channels
Stable in-house environment	
High level of asset automation	
Diverse and direct sales channels	

2.2.2 Service strategy implementation requirements and barriers

Strategy transition towards servitization has been proved to be a complex and continuous organizational operation requiring resources on all functions of the company. Challenges among implementation processes of different PSS business model blocks are presented on previous research and the strategy implementation is strongly represented in the servitization research data. Di Serio et al. (2017) have presented competence requirements, organizational restructuring needs and service mindset changes among the top requirements for implementing a service-oriented strategy by examining a globally operating heavy-duty vehicle manufacturer. Baines et al. (2007) have emphasized the importance of customer perspective consideration, early customer involvement and manufacturer's organizational changes during the design phase of the PSS. Considering the organizational changes, Artto (2015) has stated that promoting the interplay between customer-specific solution deliveries and continuous service deliveries throughout the delivered system's life cycle are requirements for optimal business

results. According to Baines et al. (2017), one of the most significant challenges regarding servitization is, in fact, the efficient and effective strategy transformation process performed by the company itself. External variables such as the size of the company and local economic circumstances have also been noted to influence the process of servitization transition and the decision to servitize itself (Neely 2008).

If the PSS strategy implementation process fails regardless of the market potential and the decision to enter the market, the failure is caused by other implementation barriers. According to Baines et al. (2007), "the principal barriers to the adoption of PSS are positioned at both sides of the dyad: consumers may not be enthusiastic about ownerless consumption, and the manufacturers may be concerned with pricing, absorbing risks, and shifts in the organization, which require time and money to facilitate." The company might also realize that providing services is beyond their competency scope and make a conscious exit decision (Oliva & Kallenberg 2003). PSS strategy implementation barriers identified by earlier research are presented in Table 7.

Table 7. *PSS strategy implementation barriers*

Author	Industry/ aspect	Barrier
Kuo et al. 2010	External	Lack of support from relevant laws and regulations Lack of market acceptance
	Internal	Lack of strategic planning Rejection of change by internal personnel Lack of an ideal management information system Lack of training and education Lack of technical personnel and support Lack of support from senior management Lack of awareness related to PSS
	Maintenance	Load increase in maintenance service system Difficulty in managing components for maintenance service
	Remanufacturing	Different recycling time and quantity as well as product quality Difficulty controlling and managing materials Lack of reverse logistics
Kurak et al. 2013	Medical equipment	High durability and long life cycles of the assets Low levels of product upgrades Human resources, organization culture.

Author	Industry/ aspect	Barrier
Barquet et al. 2013	Machine tool manufacturing	Financial uncertainties Difficulty of pricing Taxation questions Defining the service development process Training of employees Internal resistance due to employees' unawareness of the potential generated value Already available financial solutions for asset acquisition (development banks)
Petrulaityte et al. 2017	Distributed manufacturing	Lack of financial resources to implement and run PSS business models Challenges to define customers' purchase and service acceptance behavior Developing PSS for a specific local context and culture Lack of know-how towards PSS-oriented designing and developing Customer concerns related to the hygiene of used or shared products Customer concerns regarding their privacy caused by the requirement for PSS provider to access their personal data or even enter into their property Lack of external infrastructure for end-of-life stage collection, recycling and remanufacturing

Sundin et al. (2005) have conducted a case study to examine the extent of forklift truck adaptation readiness towards functional sales, basically meaning long-term rental or leasing contracts. The majority of their improvement proposals deal with the accessibility of parts and components needed to be accessed during remanufacturing and maintenance operations. Their research has not considered economic effects, but their suggestions have been seen as easy and affordable to perform. Sundin et al. (2005) have also stated that the increased competition and EU directives such as WEEE (*Waste Electrical and Electronic Equipment*) and RoHS (*Restriction of Hazardous Substances*) boost the concepts of ownerless asset usage. Swedish companies were also surveyed, and the results indicated that the companies believed in increasing PSS sales volumes in the future.

Despite the varying research results between servitization drivers and barriers, Neely et al. (2011) have concluded that organizational capabilities, corporate culture building and will of change can be seen as the most important factors for successful servitization implementation process.

2.2.3 Effects after servitization decisions

Earlier research has provided evidence on both the positive and the negative effects caused by servitization decisions. Those contradicting arguments have formed circumstances in which neither option can be seen to act as a de facto consequence for all servitization situations. **Service paradox** defines the ongoing debate and contradictory research evidence concerning the manufacturer's actual financial consequences of servitization decisions (Neely et al. 2011). Contradictory findings have been observed widely in earlier research. In a case study by Baines & Lightfoot (2013), the manufacturer's operating income has turned negative due to increased costs, even though the revenues have expectedly increased. The most usual reasons for these profitability problems were incorrect service contract pricing and poor cost and risk management during the contract lifetimes. The contradicting findings may also be resulted by operational, cultural and attitudinal changes having profound implications for the company and its entire business network (Kowalkowski et al. 2017). As Oliva & Kallenberg (2009) have summarized, "It is difficult for an engineer who has designed a multi-million dollar piece of equipment to get excited about a contract worth $10,000 for cleaning it." As Reim et al. (2015) have pointed out, PSS implementation processes remaining "an important yet understudied area of research in the PSS literature" is another major aspect indicating the lack of earlier research conducted towards the subject. Due to the acknowledged paradox, this chapter presents a bilateral review of the earlier research findings regarding both the positive and negative effects detected after strategy transformation towards service-based offerings.

Positive results directly linked to specific industries or industrial sectors are presented in Table 8 while the negative evidence is presented in Table 9. Tables consider the findings from both the supplier's and customer's points of view and they also present the researched industries as well as the used research methodologies and Tukker's (2004) PSS types described in chapter 2.3.1.

Table 8. *Positive industry-specific servitization effects*

Author	Industry	Methodology & PSS type	Detected benefits
Tukker 2004	Transport	Literature review	Emphasized user relationship during the use phase of the PSS offering.
Lindahl et al. 2014	Soil compactors Paper mill equipment Building exterior cleaning	Case studies from real offerings Semi-structured interviews Questionnaires **Sample:** 3 separate real business cases PSS Types: U1, R2, R3	Familiarized the asset's operating performance, conditions and most replaced components through remanufacturing and established relationships with asset rental companies. Remanufacturing increases the asset's leasability years leading to a longer revenue generation phase. Motivated development of durable assets with long lifetimes and low maintenance costs due to the provider's responsibility for maintenance, repair, etc.
di Serio et al. 2017	Heavy trucks	Single case study Qualitative data collection: Semi-structured interviews Document analysis PSS Type: U1	Increased sales of services in strongly cyclical product markets to maintain a more constant and predictable revenue flow. Repetitive purchases and increased customer loyalty. New revenue streams through optimized value chains.
Bressanelli et al. 2018	Household appliances	Qualitative case studies: Interviews PSS Type: U1	Customer treatment and component lifetime expectancy analyses enabled through IoT systems.

Table 9. *Negative industry-specific servitization effects*

Author	Industry	Methodology & PSS type	Detected challenges
Oliva & Kallenberg 2003	Machine manufactu ring	Semi-structured interviews Questionnaires Archival assessment of organizations service integrating experience **Sample:** 11 German equipment manufacturers PSS Type: P1	Creating a global service infrastructure capable of local responding. Diffusing knowledge across the internal product-service network. Managing large organizations of service personnel. Making an explicit decision about the degree of standardization in order to balance between transferability and customization. Replicating HR and knowledge management for the service network. Marketing between service and customer networks.

Author	Industry	Methodology & PSS type	Detected challenges
Kurak et al. 2013	Medical equipment	Case study Team manager interview PSS Type: R2	Decreased customer status and other factors considering the loss of ownership.
Lindahl et al. 2014	Paper mill equipment	Case studies from real offerings Semi-structured interviews Questionnaires PSS Type: R2	Reduced demand due to increased reusability possibilities.
Benedittini et al. 2015	Manufactu ring	Quantitative study **Sample:** 212 bankrupted firms with servitization history PSS Types: Multiple	Increased internal bankruptcy risk of manufacturers.
Bressanelli et al. 2018	Household appliances	Qualitative case studies Interviews PSS Type: U1	"Loss of ownership" related issues, such as unwillingness to pay.

Besides the industry-specific consequences, research has also been broadly conducted towards more generic challenges and risks of industrial service strategy implementations. These findings are presented in Table 10.

Table 10. *Negative effects caused by servitization*

Author	Challenge
Baines et al. 2007	Pricing failures Risk absorption Organizational shifts requiring resources Problems related to ownerless consumption
Valtakoski 2007	Solution does not meet expectations, customer rejection Value generation failure Functionality issues Customer's knowledge not taken into high enough consideration or relied too closely on. Manufacturer's own lack of knowledge Lack of integrative capabilities High implementation costs
Neely 2008	Business model redesign Understanding customer value instead of manufacturer value Timescale changes of: *Managing and delivering multi-year partnerships* *Managing and controlling long-term risk* *Modeling and understanding new profitability implications*

Author	Challenge
Neely 2008, Baines et al. 2009a	Required mindset shift problems of: *Design* *Marketing* *Sales* *Customers*

When Table 10 is observed, a consensus regarding especially the organizational and policy-related PSS implementation challenges is clearly visible. Different authors have emphasized the benefits and challenges not directly linked to the production or sales processes, but more to the ways of internal acting and models of external operating. This notion draws a conclusion that implementing a PSS business model might affect the company's manufacturing processes less than expected while the main changes are related to the operational decisions and policies. The earlier research brings forth the importance of mostly intangible needs and requirements. Regardless of implementing the PSSs, companies are still enforced to maintain their core competency and skill utilization which in the manufacturing industries is usually tied to the physical products. The main product-related benefits are results of for example product modulating and process scalability, but the product's operating and ability related matters are mostly unaltered.

Besides financial matters, both individual and dyadic knowledge consequences have also been seen to take place when PSS offerings have been created. Valtakoski (2017) has stated that as possible benefits, cooperating companies have the potential to learn about their own knowledge components which might lead to an increase in the company's own knowledge depth. Companies can also learn from each other since part of the transferred knowledge during solution implementation is likely to be absorbed by the other party. New knowledge might also be created during the close collaboration. As one servitization risk from this point of view, Hamel (1991, cited in Valtakoski 2017) has stated that collaboration exposes the company's unique knowledge to the other party which might result in unintentional knowledge leakage. This can be seen as a significant risk, especially if knowledge is a major source of the company's competitive advantage. This risk might result in withholding of knowledge.

In addition to economic drivers and benefits for manufacturers and customers, industrial servitization has been found to create broader indirect effects also influencing environmental and societal sustainability. In addition to economic effects, these factors can also be regarded as PSS strategy influencers since brand reputation, company values and societal acceptance are major decision-making influencers for manufacturing

companies eventually enabling customer acceptance and growth of economic profitability. Since the 1990s, PSSs and functional sales in general have been regarded as major instruments for moving societies towards a resource-efficient circular economy and creating the anticipated “resource revolution” (Tukker 2015).

In 2002, Mont has stated the following arguments regarding environmental possibilities of PSSs:

- *Understanding PSSs can help governments to formulate policies promoting sustainability and circular economy in industrial consumption.*
- *Offering alternative product-use scenarios brings the potential of decreasing the total amount of produced products.*
- *Manufacturers are encouraged to take responsibility for the post-life processes.*

    - *These factors together with the potential of technical dematerialization development decrease environmental waste.*

Scholars have widely brought forward the facilitative capabilities of PSSs for societal dematerialization and environmentally beneficial product design (Mont 2002; Doni et al. 2019). Regardless of these visions, generally accepted evidence on environmental benefits by definition has remained non-existent (Tukker 2015) after Mont’s arguments in 2002. A considerable amount of research has been conducted towards means with which the industrial service development could lead towards environmental improvement, but the majority of the actual findings have either been very case-specific or purely theoretical without practical evidence data. Doni et al. (2019) conclude that even though servitization has been proven to improve certain factors, such as energy consumption and overall environmental performance, evidence has also been presented that its meaningful effects towards actually meaningful corporate policies, such as emission reduction or environmental supply chain management, have remained scarce.

Regardless of debatable research results, hypotheses of the positive environmental effects have also been presented in the earlier research. UOPSSs and POPSSs have been noted to contain the highest potential for environmental benefit since the manufacturer’s risks and responsibilities are higher than with POPSSs. This would encourage manufacturers to prolong asset life cycles and reliability levels through qualified manufacturing processes with competent repairs and maintenance procedures (Reim et al 2015; Lindahl et al. 2014). According to Correa (2018), the non-transferred ownership of the assets also creates more sustainable decision-making incentives for the manufacturers. Compared to situations in which the manufacturer merely sells the

physical assets to the customers and has an incentive to minimize the production costs, servitization also drives manufacturers to maximize the effectiveness of operating and disposal processes of the assets. Lindahl et al. (2014) have presented some case-specific evidence of environmental PSS benefits in form of recycling, remanufacturing, reuse, maintenance, and operations planning improvements enabled by flexible operations and close customer relationships caused by servitization implementation.

Economic, environmental and societal effects together create the “triple-bottom-line of sustainability”, which According to Lee et al. (2012) is essential for evaluating the overall benefit payoff of a PSS and also outweighs the performance levels of separate components alone. Drawing general conclusions of PSSs’ preferability from environmental perspective have been made (Lindahl et al. 2014).

2.3 Industrial asset-based service business models

As PSSs compile products and services into packages and turn them into solution offerings, they enable traditional product and service expertise to be sold with totally new kinds of business models. The models differ all the way from basic maintenance contracts, supply of consumables and consultancy to outcome-based functional results in which the customer might not be aware of the particular assets or procedures with which the demanded outcome is provided, as long as the agreed outcome conditions are met.

Instead of simple product-service combinations, PSSs integrate product and service components to achieve differentiation and therefore provide additional customer value (Baines 2007). To achieve this, earlier servitization research has brought up the importance of organizational integration. According to Artto (2015), the organizational integration procedures between the company’s product and service segments both enable and further encourage the development of novel PSS business models. External partner network integration has also been found as another key element of these new business models to optimize the value chain effectiveness (Di Serio et al. 2017).

This chapter introduces all PSS categories originally published by Tukker (2004). It later focuses on the business model components with asset transportation to customer facilities without transferring the ownership and therefore the risks and responsibilities from the supplier. This approach is selected due to the common roles of electric motors

in production processes; industrial manufacturing processes are enabled and powered but not totally conducted by electric motors.

2.3.1 Business model categorization

The first general introduction of PSSs presented by Mont (2002), is shown in Figure 4. The model acts as a frame for all separate PSS business models presented later in Figure 5.

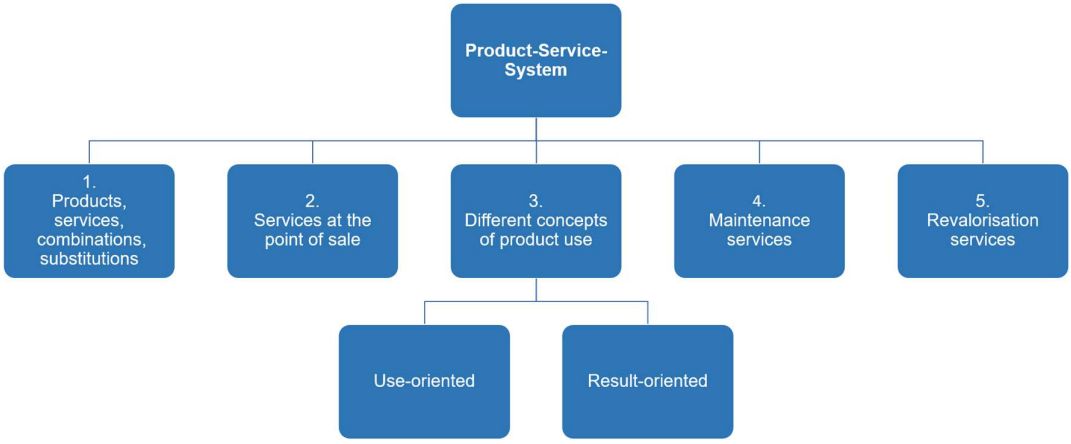

Figure 4. *First public classification model of Product–Service-Systems (Mont 2002)*

Five separate blocks form the foundation of Mont's (2002) PSS classification model and the scholar herself has also provided an explanation for each of the blocks. Due to e.g. material and energy inputs, products substituted entirely by services are mainly an ideological category without a considerable number of examples. Consequently, the first block consists of all the direct products, services and combinations included in the PSS. The second block points out those services which are offered to the customers at the point of sales, such as financing solutions and marketing. The third block is divided into two orientation options, UOPSS and ROPSS. The concept might require the user to extract the product's utility or provide the utility itself directly to the customer. The fourth block includes services that intend to prolong the product's life cycle, for example, hardware upgrades and software updates. The last block includes the services which are designed to close the products' material cycles by for example secondary utilization and therefore enhance circular economy. (Mont 2002.)

Since Mont's (2002) classification, a closer observation towards different PSS business model types has been conducted. Models have been multilaterally divided into different categories depending on the angle of observation, specific industries and the categorizing scholar. According to Seregna et al. (2016), the categorization model presented by Tukker (2004) is still the most widespread and largely accepted. The conducted analysis of earlier research for this study's purposes proves that argument valid.

Tukker's categorization model contains three main business model categories and eight sub-categories. The full categorization frame and closer observation of separate business model types are presented and introduced in Figure 5 and after it. To ease referencing later in this study, each subcategory is also given an abbreviation. The abbreviations are displayed next to the headings of each subcategory in the tables below the main category introductions.

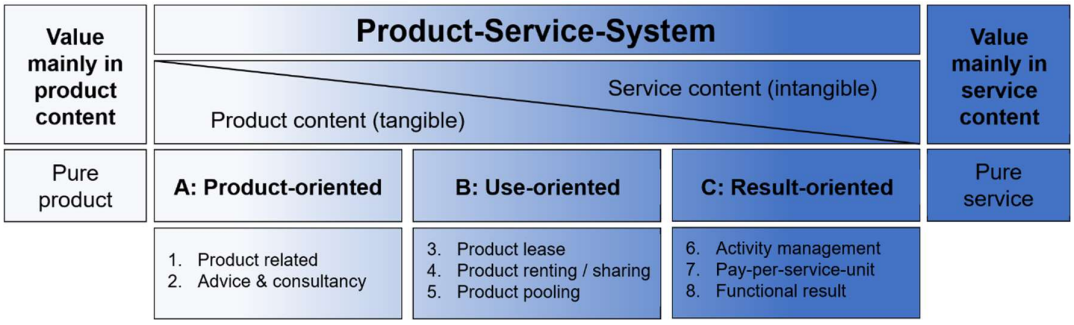

Figure 5. *Main categories and subcategories of PSS business models (Tukker 2004)*

1. Product-oriented Product-Service-Systems (POPSSs)

The product is promoted and sold in a traditional manner and the services might be included in the original act of sale. The business model still mainly leans towards product sales with some extra services added. Manufacturer motivators to introduce POPSS include minimizing costs for a well-functioning and long-lasting product. POPSS sub-categories *Product-related services (P1)* and *Advice and consultancy (P2)* are presented in Table 11. (Baines 2007; Tukker 2004.)

Table 11. *POPSS sub-categories (Tukker 2004)*

Product-related services (P1)	Advice and consultancy (P2)
Provider offers services for the use phase of the installed product. Examples: Maintenance contracts Consumable supply Take-back agreements	Provider offers advice on the most efficient use of the product. Examples: Organizational structuring Logistics optimization

2. Use-oriented Product-Service-Systems (UOPSSs)

In UOPSSs, the product still plays a central role in the offering, but the business model does not entirely rest on product sales. Product's usage or availability is sold without transferring the product's ownership to the customer and the product's availability is provided for example by leasing or sharing. Manufacturer motivators to introduce UOPSSs include maximizing the product's usage level and extending the product's life-cycle. UOPSS sub-categories *Product lease (U1), Product renting or sharing (U2)* and *Product pooling (U3)* are presented in Table 12. (Baines 2007; Tukker 2004.)

Table 12. *UOPSS sub-categories (Tukker 2004)*

Product lease (U1)	Product renting or sharing (U2)	Product pooling (U3)
Product ownership is not transferred. The provider is often responsible for maintenance, repairs and control. The lessee (user) pays regular fees for normally unlimited and individual access to the product.	The main difference to p*roduct lease:* Other users might also use the product at other times. Therefore, the product's usage is sequential by different users.	The main difference to *product renting or sharing:* Simultaneous use of the product.

3. Result-oriented Product-Service-Systems (ROPSSs)

Instead of the product itself, the business is based on the sales of its outcome or capability. A customized mix of services is offered without transferring the product's ownership and the customer only pays for the agreed result provisioning. ROPSS sub-categories *Activity management/outsourcing (R1), Pay-per-service-unit (R2)* and *Functional result (R3)* are presented in Table 13. (Baines 2007; Tukker 2004.)

Table 13. *ROPSS sub-categories (Tukker 2004)*

Activity management/ outsourcing (R1)	**Pay-per-service-unit (R2)**	**Functional result (R3)**
Part of the company's activity is outsourced to a third party. Examples: Catering Office cleaning	PSS's basis is a fairly common product, but the customer pays only for the output according to the level of usage. The provider is responsible for all activities needed to keep the function available. Example: Pay-per-print copiers	Provider and customer agree with the delivery of a certain result. The provider is free to decide the most suitable way to deliver the agreed functional result to the customer.

In Tukker's model, the three PSS main categories are located between pure product systems and pure service systems on a product-service continuum (Figure 5) originally presented in the same publication. Since then, Lay et al. (2009) have depicted a morphological box (Figure 6) as a generalized framework for PSS business model development. Each of the "paths" from top to bottom of the box can be seen to represent a possible business model concept between a pure product and a pure service offering.

Characteristic features		**Options**			
Ownership	during phase of use	Equipment producer	Leasing bank	Operating joint venture	Customer
	After phase of use	Equipment producer	Leasing bank	Operating joint venture	Customer
Personnel	Manufacturing	Equipment producer	Operating joint venture	Customer	
	Maintenance	Equipment producer	Operating joint venture	Customer	
Location of operation		Equipment producer's establishment	Establishment "fence to fence" to the customer	Customer's establishment	
Single / multiple customer operation		In parallel operation for multiple customers		Operation for a single customer	
Payment model		pay per unit	pay for availability	fixed rate	pay for equipment

Figure 6. *Morphological Box tool for PSS business model development (Lay et al. 2009)*

2.3.2 Ownership options for fixed assets

With industrial assets, the event of purchase has traditionally been seen as the moment of ownership transfer. PSS offerings can differ from this definition since ownerless consumption is one of the main characteristics of certain types of PSS business models (Annarelli et al. 2019). Lay et al. (2009) present in their morphological box (Figure 6) that the asset ownership can be divided into two stages; “ownership during the phase of use” and “ownership after the phase of use”.

Ownership during the phase of use defines the property rights of the assets and related equipment during the contract term. Different options vary from the possession of the asset remaining with the manufacturer to the asset being sold for a market price to the customer after the use phase. According to Lay et al. (2009), a range of other options between these two “extreme” options also exist. Depending on the usage, amount and value of the assets, they can be sold to a bank or other external third-party which then leases them back to the manufacturer or directly to the customer. The customer then has a joint venture option with the bank or some other third party to buy the assets. These alternative ownership models have been created to avoid problems with i.e. accounting of the manufacturing company due to the inevitably growing balance sheet value of the assets.

Asset utilization models where some types of rental elements between lessees (asset users) and lessors (asset providers) are included is called leasing (Tepora, 2013). Leasing typically lowers the capital requirements of customers and therefore might also act as a driver for PSS business models including leasing components. It is commonly divided into *operational leasing* and *financial/capital leasing* based on asset ownership, risk liabilities, lease periods, ratios between residual and original asset values, and other contract-specified matters. Industrial asset leasing typically consists of long and pre-determined rental periods, complex payment plans and judicial responsibility evaluation. Concerning the possible accounting problems mentioned earlier, the main difference between the two types of leasing is the asset’s visibility on the lessee’s balance sheet. Financial leases are recognized as equity, whereas operating leases are treated as expenses and therefore are not noted on the balance sheet. The definition between operational and financial leasing types ultimately depends on the transfer of risks and rewards and assets ownership after the phase of use.

To enable ownerless consumption for the customers without third-party joint ventures or accounting issues, earlier research has also analyzed cases where companies have created separate internal organizations for financial services. These “banks of the companies” have then been used for similarly to regulated banks for product financing and operational leasing. This has also been used to illustrate the reconfiguration of business models derived from the servitization strategy decisions (Di Serio et al. 2017).

When earlier research is observed, a deduction can be made that with PSS business models with considerably big and valuable amounts of assets, such as electric motors, third-party financiers are considerable or even sole options to achieve profitability and maintain the business model itself. The bilateral arguments behind this conclusion are presented next.

Asset ownership staying with the manufacturer (no third party ownership holder):

- Massive asset value increase on manufacturer’s balance sheet
- Capital tied to non-profitable objects
- Customers not tied to long-term relationships

Asset ownership moved to the customer (no third party ownership holder):

- Increase in required customer capital (/financial support) to gain access to the assets
- Complex supply of services compared to PSS contracts
- Customers not tied to long-term relationships

Bülbül et al. (2014) have studied the growing trend of leasing-related activities of banks, bank subsidiaries or partner leasing companies in pursue of profitability. Their research found various bank performance measures indicating beneficial effects created by leasing and outsource of customers’ risk. Based on those findings, a conclusion can be made that especially during the ongoing global low-interest environments still in place after the financial crisis of 2007-2009, banks have been showing interest towards financing the leasing business of industrial asset manufacturers for stable and low-risk interest incomes. This can then further be used to draw a conclusion that in addition to industrial manufacturers, banks also possess drivers towards industrial PSS business as third-party financiers.

Ownership after the phase of use clarifies the property rights of the assets after their operating life is over. According to Lay et al. (2009), two common operational options are widely adopted; depending on the use phase's ownership, the assets can either remain or return to the possession of the manufacturer for different operations such as upgrading or recycling. The property rights can also remain or be retained with the customer after the joint venture is expired or terminated. (Annarelli et al. 2019.) In the case of leasing, financial leasing contracts often include asset purchase options/requirements at the end of the phase of use. These contracts include the cases where a third-party financial institution has been part of the service triad in addition to manufacturer and customer.

2.4 Synthesis

Based on the reviewed literature regarding servitization, PSS offerings it has created and business models that have been used to utilize and gain profit out of it, the high interest towards the subject is clearly visible. One of the most extensive bases of existing information has addressed the general and theoretical effects of industrial servitization strategies. On the other hand, an extensive portion of research has also been conducted towards specific industrial sectors and even specific assets and the strategic transformation processes behind them. As a negative side effect, this has thus narrowed and contested the reliability of available data regarding the practical transformation process of industrial servitization, since the research methodologies and samples have mainly been either totally theoretical or entirely concentrated on a specific asset or asset types. Research covering industrial servitization through practical case studies from different industrial sectors has been scarce.

Results for this study's first research question regarding the *factors driving or preventing industrial manufacturers to transform their business models towards servitized solution offerings* are reasonably well studied and established due to the high generalization of the question. Various scholars have identified drivers from different industrial sectors, also with different research methods, which advocates high reliability of those findings. The main drivers can be clearly divided into improvements between differentiation, customer relationships and revenue streams. A conjunctive factor for each of them is the emphasis of the customer's perspective during all stages of the servitization processes. Compared to traditional product-based business development, successful PSS transition processes have been proved to require active customer relationships to enable efficient and accurate customer value analysis. Tailored PSS offerings designed to directly meet these acknowledged values enable manufacturers to

increase customer value generation and thus also increase profitability and competitiveness. Based on the reviewed literature, a conclusion can be made that the price and technology competition subjected by the emerging markets has and will continue to force traditional and established manufacturers to reorganize their key growth strategy components. On the other hand, manufacturers with high and long-term images as reliable and stable asset suppliers have typically stabilized well-established customer relationships, which might decrease the urge for major resource-consumptive organizational rearrangements.

Since the majority of earlier research has been conducted towards the servitization of machinery, tools and heavy vehicles, earlier research data covering electric motors as the subject is basically non-existent. The number of earlier studies providing insight towards other types of “process-powering assets” has also remained scarce. Therefore, extended research considering *an asset management service as part of a business model used to servitize industrial electric motor offerings* is necessary. As a subject affecting those PSS business models to be developed for electric motors, research towards industrial asset management has brought forth multiple justification arguments to direct the research towards business models with third party asset owner actors. Transferring ownership to the customer would first increase the customer’s investment capital requirements. With traditional business models, customers requiring external financiers bring those financing actors to parts of their business operations but leave them out of the direct service triads. Selling assets and services separately for each customer can also actually complicate the manufacturer’s customer process management and due to the provided option for the customers to buy the service from other service providers, it could have a decreasing effect on establishing long-term customer relationships.

3. METHODOLOGY

This chapter describes the design and processes of this study's empirical research. The main purpose of this study's empirical part was to present and analyze the most efficient value-creating features for an asset management service (AMS) to be used with industrial electric motors. Empirical research started with internal Case Company planning meetings to discuss and develop the most efficient methods to expose the most valued benefits that the AMS could provide for both the customers and for the Case Company. The idea of the research was to gather both external and internal data, point out the most important aspects and value features that the AMS should include and then define the AMS concept based on the gathered data.

3.1 Research design

Due to the research questions and other themes of this thesis, the empirical part of this study is a qualitative, constructive case study research utilizing panel interview analysis. Non-numericity and challenges in exact measuring of the results are both main characteristics of all qualitative studies. Usage of individual employees as estimation data sources also highlights the meaning and importance of the researcher's own interpretation (Saunders 2011, p. 115). The purpose of the empirical research is to provide practical data regarding an asset management service as part of a service-based business model for industrial electric motors. The case study approach is used to collect empirical data for the research process. Thematic interviews form the most basic type of data collection used with case studies and the thematic frame of references presented in chapter 2.2 was utilized in the data collection and the reviewed literature was used as a tool of the analysis frame. The research design aimed to construct a definition for an asset management service using external and internal panel interviews as its data sources.

Bilateral panel interviews were selected as the case study's data gathering method. Internal and external panels provided data through constructed interview frames. The dimensions and structures of the panel interviews were provided by the Case Company according to the preferences they regarded as the most pivotal ones. These dimensions were gathered via meetings and internal discussions and the main AMS themes of which

the Case Company wanted customer value generation potential to be examined were the following:

- *Unifying customer's asset base*
- *Asset base modernization*
- *Increasing performance of maintenance operations*
- *Simplifying procurement operations*
- *Risk management*
- *Asset storage*

For internal panel queries, the Case Company's preference was to examine the internal personnel's aspect on asset management service's potential positive effects towards the themes:

- *Increasing revenue / EBIT*
- *Customer lock-in*
- *Positioning as the market leader*
- *Blocking competitors*
- *Strengthening customer relationships*

After internal discussions and meetings, these themes were dismantled into 19 separate external topics (Appendix A) and 9 separate internal topics (Appendix B). These external and internal topics were then provided to the interview contacts for estimations as part of the panel interview frames.

After the interview round, the query results were analyzed and used to reveal the internal and external top five value features of the AMS under definition. The Case Company adduced 5+5 value features to be the most adequate amount for their preferences. The value features that emerged after that process were then used as a frame for the final service concept definition. This research process is presented in Figure 7.

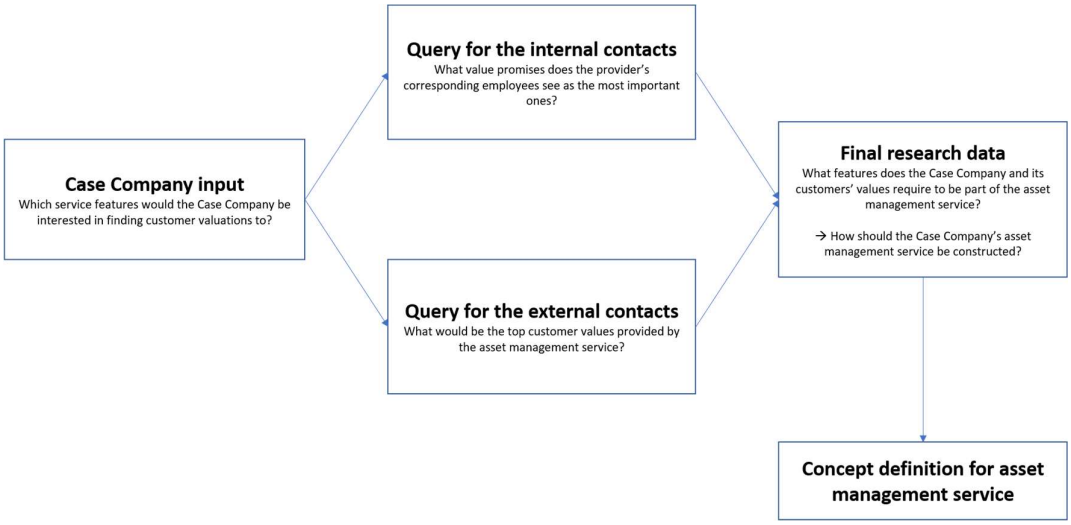

Figure 7: *Empirical research process*

3.2 The Case Company

This study's Case Company is a subsidiary of a global multi-industrial technology corporation with a widescale offering base and approximate annual revenue of 25 billion euros (2018). The corporate is a pioneering market and technology leader in for example electrification, utilization and transportation sectors and has a strong foothold in Finland with electric motor design and manufacturing processes conducted by its Finnish subsidiary. The Case Company has been utilizing a service offering model for electric motors consisting of spare motor handling and storage, but a revised a more thoroughly service-oriented business model which this thesis has been assigned to help with has been their target.

For the Case Company, the main motivators for this thesis are presented below:

Defining an asset management service and increasing service business volumes which would result to the following outcomes:

- For the Case Company:
    - Increase in stability and foreseeability of service business cash flow
- For the customers:
    - Possibility to concentrate resources to business development instead of balance sheet value
    - Possibility to gain access to the motors without ownership related risks and requirements

Case Company's customer base for electric motor business is diverse as is the manufactured electric motor offering pool. Motors are provided practically to all industrial sectors, either directly to the end-users or to other asset manufacturers which then use the motors to power their own offerings, such as pumps, fans, gearboxes or conveyors. The majority of electric motors end up in industrial environments, such as factories. The nature of the electric motor business is based on established and stable relationships between the manufacturer and its customers. Customers have preferred to use a single motor supplier for all of their operations to ensure efficient and rapid service and maintenance actions. One of the Case Company's drivers to define a more thorough AMS is indeed to increase customer retention and commitment to also other products and services.

The asset management service concept that this study aims to define is mainly targeted towards small, low-voltage process running induction motors ranging approximately from 5 to 4500 kilograms. The amount of these motors per customer order can raise up to several hundred, which compared to larger motors with regular order amounts varying from one to eight makes it possible to regard them as "bulk". According to the Case Company, the distinguishing features of their motors compared to competitors are efficiency, reliability, utilization of the latest technical solutions and practically limitless customization possibilities. They also fulfill all international and national requirements for energy efficiency statutes and are designed to function in harsh industrial environments.

Asset management in this context defines the comprehensive offerings in which the electric motors (assets) are provided for the customers. Management of the assets includes i.e. ownership, maintenance, condition monitoring, repair and replacement related contractual agreements between electric motor customers, the Case Company and potentially some external third-parties as i.e. asset ownership holders. The Case Company has earlier been offering asset management in form of services in which the customer has signed a service contract which assures at least repairs and replacements for the motors but also obligates the customer to buy the motors as in a traditional product business. With the AMS under definition in this study, one of the Case Company's targets is to erase the customers' need to purchase the assets and increase its own service business revenues.

3.3 Data collection

Primary data for this empirical study was collected from both the Case Company's internal employees in charge of corresponding subject areas as well as from the Case Company's present electric motor and electric-motor-related service customers. This bilateral approach was selected since it took both customer and supplier value generating features into account and therefore enabled the maximum overall value generation potential of the final AMS under definition as requested in the second research question. Supplier value generation generally eases the internal acceptance and required strategic decisions in the implementation phase in the future, including i.e. organizational changes. Features generating customer value, on the other hand, are crucial to all commercial products and services and the value generation potential often defines the overall success and the final market penetration effectiveness of any offering. This empirical research regarding supplier and customer value was mainly used to provide data for research question 2.

Due to the long durations and conversational and contemplating manner of the panel interview planning meetings, they were all audio recorded. The external and internal panel interview frames were constructed together with a corresponding Sales Manager from the Case Company for the following reasons:

- Maximizing this study's benefit potential
- Easing the estimation and answering processes for the interviewees
- Maximizing the relevancy of the gathered data to be used in other future undertakings of the Case Company as well

The panel interview design began with a consensus that to avoid situations where the internal interviewees would have more input than able to be provided through the numerical estimations, the interviews should be complemented with more open verbal questions. This same idea was also utilized with the numerical estimations as both external and internal contacts were provided with rows for the interviewees to fill and estimate themselves. The verbal questions for the internal contacts were:

1. *What added value would an asset management service for electric motors (possibly using external ownership party) provide for the Case Company from a perspective of electric motor manufacturer/supplier?*

2. *What would you consider as the biggest disadvantages/risks of an asset management service described in question 1:*
    a. *From the Case Company's perspective?*
    b. *From the customer's perspective?*

External contact selection was based on customer companies which either already were Case Company's spare motor service (chapter 3.2) customers or had adduced interest towards it or towards some other kind of asset management services that the Case Company does not yet offer. They also had to be familiar with the concept of ownerless usage. Another dimension influencing the contact selection was data gathering from a variety of industrial sectors and a variety of different sized companies. External data was essential for this study since the targeted outcome is intended to be utilized with real external customers, most likely also with the ones used as the external data sources of this study. After the customer companies which fulfilled the criterion described were selected, a corresponding Sales Manager from the Case Company provided a contact list to assure the quality and reliability of the output. All contacts were familiar with the Case Company and its electric motor business relationship with their own employer and therefore they could be regarded as acquainted with the subject. The final external interview contacts were selected from Case Company's customers which met the set criteria. The summary of the external interview contacts is presented in Table 14.

Table 14: *External contacts of the empirical research*

Company	Industry	Size group (employees)	Contact	Job title
A	Forest	25.000	**A1**	*Lead Buyer*
			A2	*Sourcing Director*
B	Petroleum	5.000	**B1**	*Development Manager*
			B2	*Sourcing Specialist*
C	Mining	1.000	**C1**	*Electrical & Automation Manager*
D	Forest	10.000	**D1**	*Sourcing & Logistics Manager*
E	Metal	15.000	**E1**	*Commodity Manager*
F	Chemical	5.000	**F1**	*Sourcing Manager*

All companies from which the external data was gathered are real and operate globally on a variety of sectors, such as forest, petroleum or metal industries. They all base their operations to factories or other industrial facilities and processes to which the Case Company has provided process-running electric motors. Their size groups varied

from 1.000 to 25.000 employees and annual revenues varied from 325MEUR to 14.9 billion euros. The most usual positions of customer company contacts were either sourcing managers or buyers. External companies that this study did not consider would be non-industrial or not related to any asset management or service offerings provided by the Case Company.

In the panel interviews, the external contacts were instructed to indicate the importance of each presented value feature as part of an electric motor asset management service. The themes of the value features are presented in this study's research design chapter 3.1. To simplify, the external interviewees were asked to answer the question

On a scale from 0 (minor) to 4 (major), how important would this value feature be for your company as an electric motor customer if an electric motor asset management service could provide/create it?

Each value feature was presented on the external panel interview frame (Appendix A). The rating scale was set from 0 to 4. The lower the value, the lower that particular value feature's effect on the customer's interest towards the service would be according to the external contact. Value 0 meant that that value feature's involvement in the AMS under definition would not affect the customer company's final purchase decision in any way and that feature would be irrelevant for them. Value 4 meant that including the particular value feature to the AMS would have a significant effect on the customer's interest towards the offering and would create a notable advantage for the supplier against its competitors.

To support the external customer data and widen the perspective of this study, adequate interviewees from within the Case Company were also selected and approached. These contacts were selected based on their knowledge and expertise towards the customer companies and the nature of the actual electric motor service business. Except for Contact D, all of the internal contacts worked with an industrial segment, such as forest or mining, that had a corresponding customer company acting as an external data source for this study. This created a well-connected network data source network for this empirical study. All internal contacts also had long working backgrounds from the electric motor business regarding products and services, customer interfaces and sales-order-delivery processes and that was also how they were familiar with the concept of asset management. The most usual roles of the internal contacts were either managerial sales

or key account positions. The summary of the internal interview contacts is presented in Table 15.

Table 15: *Internal contacts of the empirical research*

Contact	Job title	Customer industry
A	*Account Manager*	Forest
B	*Segment Manager*	Metals & Mining
C	*Sales Director*	Pulp & Paper
D	*Sales Manager*	Energy
E	*Sales Manager*	Chemical

Internal contacts that this study did not approach were employees who did not cooperate with electric motor customers on a frequent daily basis. Employees without pointed customer segment responsibilities were also excluded from potential panel interviewees.

The internal panel interview frame began with three interrogatory questions concerning added value generation of and asset management service and the biggest risks it would create for both the supplier and the customer. The internal contacts were then instructed to indicate the potential of each possibility that the electric motor asset management service could create for the Case Company as an asset manufacturer and supplier. The themes of the value features are presented in this study's research design chapter 3.1. To simplify, the internal interviewees were asked to answer the question

On a scale from 0 (minor) to 4 (major), how important would this value feature be for the Case Company if an asset management service offering for electric motor customers could provide/create it?

Each value feature was presented on the internal panel interview frame (Appendix B). The rating scale was set from 0 to 4. The lower the value, the lower that particular value feature's potential value generation ability would be according to the interviewee in question. Value 0 meant that actualization of the particular value feature with the new AMS offering under definition would not be notable or meaningful for the Case Company. Value 4 meant that that value feature's actualization would create significant value for the Case Company and would therefore be a highly important output of the AMS under definition.

Identified drivers and barriers as well as acknowledged actual effects of industrial servitization decisions were gathered from earlier literature, empirical study and from the Case Company's inputs for the empirical study to provide data mainly for research question 1. Compilations of drivers and barriers are presented in Tables 16 and 17. Literature sources for driver data were Mont (2002), Baines et al. (2007), di Serio et al. (2017), Correa (2018) and Doni et al. (2019).

Table 16: *Identified industrial servitization drivers*

Industrial servitization drivers	**Literature (source)**	**Empirical study (contact)**	**Case Company**
Appropriate responding to customer demands	**Mont 2002**		
Increased customer relationships and customer retention			
Improved competitiveness through improved environmental performance			
High-value offerings that are easily differentiated	**Baines et al. 2007**		
Released ownership responsibilities from the customer			
Increased generated value through customization and quality improvements			
Differentiation	**di Serio et al. 2017**		
Substitution avoidance			
Increased customer dependence and loyalty			
Financial motivation from increased service sales			
Maintaining a more constant and predictable flow of revenues			
Stimulating repetitive purchases			
Difficulty for competitors to copy and "reverse engineer" the services	**Correa 2018**		
Customer retention and therefore higher profitability due to service contracts with a duration			
Lesser commoditization compared to products			
Turning customers' fixed costs to variable costs			
Ability for customers to focus on their core competencies	**Doni et al., 2019**		
Increasing profit margins and revenues			
Increasing sales			
Improving relationships leading to customer "lock-ins"			
Maintenance services for ATEX certified (explosive atmosphere) motors by an authorized service operator		B1	
Simplifying order and billing processes		B1	
Asset's life-cycle management and preparing for replacements in advance		C2	
Customer loyalty and deeper collaboration to help with other processes also		A, D, E	
Increasing and easing sales and marketing processes for electric motors and services		A, B	
Increasing customer satisfaction through fast response times		B	
Increase in stability and foreseeability of service business cash flow			X
Possibility to concentrate customer's resources to business development instead of balance sheet value			X
Possibility to gain access to the motors without ownership related risks and requirements			X
Total number: 29			

Literature sources for barrier data were Kuo et al. (2010), Kurak et al. (2013), Barquet et al. (2013) and Petrulaityte et al. (2017). The empirical study's internal contact panel interviews also produced industrial servitization barriers as the interviewees were asked to specify the disadvantages or risks of an asset management service from both the supplier's and customer's perspectives.

Table 17: *Identified industrial servitization barriers*

Industrial servitization barriers	Literature (source)	Empirical study (contact)
Lack of support from relevant laws and regulations	Kuo et al. 2010	
Lack of market acceptance		
Lack of strategic planning		
Rejection of change by internal personnel		
Lack of an ideal management information system		
Lack of training and education		
Lack of technical personnel and support		
Lack of support from senior management		
Lack of awareness related to PSS		
Load increase in maintenance service system		
Difficulty in managing components for maintenance service		
Different recycling time and quantity as well as product quality		
Difficulty controlling and managing materials		
Lack of reverse logistics		
High durability and long life cycles of the assets	Kurak et al. 2013	
Low levels of product upgrades		
Human resources, organization culture.		
Financial uncertainties	Barquet et al. 2013	
Difficulty of pricing		
Taxation questions		
Defining the service development process		
Training of employees		
Internal resistance due to employees' unawareness of the potential generated value		
Already available financial solutions for asset acquisition (development banks)		
Lack of financial resources to implement and run PSS business models	Petrulaityte et al. 2017	
Challenges to define customers' purchase and service acceptance behavior		
Developing PSS for a specific local context and culture		
Lack of know-how towards PSS-oriented designing and developing		
Customer concerns related to the hygiene of used or shared products		
Customer concerns regarding their privacy caused by the requirement for PSS provider to access their personal data or even enter into their property		
Lack of external infrastructure for end-of-life stage collection, recycling and remanufacturing		
Tied-up capital		A, B, C, D
Developing, initiating and maintaining successful asset management service business		B, E
Controlling the storage costs		A
Urgent maintenance needs, spare motor availability problems		A, B, C, D
Commitment to a single supplier and its products and services		A, B
Comprehension of the pricing model		E
Total number: 37		

After collection, the thematical frames for industrial servitization drivers and barriers were constructed as presented in Table 18. Drivers were divided into 9 groups as barriers were divided into 10 groups.

Table 18: *Thematic frame of identified industrial servitization drivers and barriers*

Drivers	Barriers
Strengthening customer relationships and customer retention, substitution avoidance	Planning, developing and maintaining the service business
Increased service sales, profit margins and revenue	Increased tied-up capital of the supplier
Releasing customer from ownership related capital and resource requirements	Urgent customer needs for spare assets or maintenance
Increasing value generation through customization and quality improvements	Lack of market acceptance, customer concerns
Easier to differentiate compared to products	Implementation resource requirements, training
Maintaining a more constant and predictable flow of revenues	Customer's requirement to commit to a single supplier
Simplifying order, delivery and asset management processes	Logistics, storage, recycling
Increasing competitiveness through improved environmental performance	Lack of internal acceptance
Easing life-cycle management	Pricing
	Laws and regulations

These identified themes were then compared to the actual, identified positive and negative effects of industrial servitization found from earlier literature, presented below in Table 19 and Table 20.

Table 19: *Identified positive effects of industrial servitization*

Identified positive effects	Source
Emphasized user relationship during the use phase of the PSS offering.	**Tukker 2004**
Familiarized the asset's operating performance, conditions and most replaced components through remanufacturing and established relationships with asset rental companies.	**Lindahl et al. 2014**
Remanufacturing increases the asset's leasability years leading to a longer revenue generation phase.	
Motivated development of durable assets with long lifetimes and low maintenance costs due to provider's responsibility for maintenance, repair, etc.	
Increased sales of services in strongly cyclical product markets to maintain a more constant and predictable revenue flow.	**di Serio et al. 2017**
Repetitive purchases and increased customer loyalty.	
New revenue streams through optimized value chains.	
Customer treatment and component lifetime expectancy analyses enabled through IoT systems.	**Bressanelli et al. 2018**
Total number: 8	

The identified positive effects presented in Table 19 were collected from six different industrial sectors varying from small household appliances to large and complex soil compactors and paper mill equipment. The studied service offering types varied from product-oriented product-service-systems (POPSSs) to result-oriented product-service-systems (ROPSSs).

Table 20: *Identified negative effects or actualized problems of industrial servitization*

Negative effects or actualized problems	Source
Creating a global service infrastructure capable of local responding.	**Oliva & Kallenberg 2003**
Diffusing knowledge across the internal product-service network.	
Managing large organizations of service personnel.	
Making an explicit decision about the degree of standardization in order to balance between transferability and customization.	
Replicating HR and knowledge management for service network.	
Marketing between service and customer networks.	
Pricing failures	**Baines et al. 2007**
Risk absorption	
Organizational shifts requiring resources	
Problems related to ownerless consumption	
Solution does not meet expectations, customer rejection	**Valtakoski 2007**
Value generation failure	
Functionality issues	
Customer's knowledge not taken into high enough consideration or relied too closely on.	
Manufacturer's own lack of knowledge	
Lack of integrative capabilities	
High implementation costs	
Business model redesign	**Neely 2008**
Understanding customer value instead of manufacturer value	
Timescale changes of: Managing and delivering multi-year partnerships Managing and controlling long-term risk Modeling and understanding new profitability implications	
Required mindset shift problems of: Design Marketing Sales Customers	**Neely, 2008 Baines et al., 2009a**
Decreased customer status and other factors considering the loss of ownership.	**Kurak et al. 2013**
Reduced demand due to increased reusability possibilities.	**Lindahl et al. 2014**
Increased internal bankruptcy risk of manufacturers.	**Benedittini et al. 2015**
"Loss of ownership" related issues, such as unwillingness to pay.	**Bressanelli et al. 2018**
Total number: 30	

The identified negative effects or actualized problems presented in Table 20 were collected from 5 different industrial sectors varying from small household appliances to paper mill equipment and machine manufacturing. As with the positive effects, the studied service offering types also varied from product-oriented product-service-systems (POPSSs) to result-oriented product-service-systems (ROPSSs).

3.4 Data processing

Since the amount of data sources was kept relatively low with 8 external customer companies and 5 internal contacts, the data gathered by the interviews had to be carefully processed and analyzed to ensure the quality and relevancy of the results.

Deviant answering habits of individuals causes a phenomenon in which some interviewee's estimate differs from another's even though they want to indicate the same significance. For example, some individuals tend to answer values only from the estimation scale's top-end whereas other individuals tend to use the entire scale from the lowest to the highest value. To take these specific answering habits and the variation created by those into account, the data analysis model was developed in a way that it gave more weight on the answers that were provided by interviewees who gave numerical estimation values from both the small and large end of the estimation scale. An example result from this is that estimations from an interviewee whose highest given value was 4 and lowest given value was 2 were taken less into account compared to an interviewee whose highest given value was 4 and the lowest given value was 0.

An example of the used data processing method is presented next. In the example case, five separate external customer interviewees A, B, C, D, and E have provided their estimations for 5 different electric motor offering features' importance/potential on a scale from 0 (not important/unrelevant) to 10 (very important/essential). The motor features that panel interviewees have been asked to provide their estimations to are *reliability, energy efficiency, costs of running, customization possibilities and storage optimization*. For example, since contact A has given the estimation value of 10 for energy efficiency, he/she sees energy efficiency as an essential feature for electric motors from their company's point of view. Some arguments might also have been left unanswered due to insufficient estimation capabilities or for other reasons. The blank estimation values have been excluded from the processing itself. Table 21 combines all gathered answers from all five interview contacts. The minimum and maximum estimation values provided by each interviewee are also presented as well as the difference between those values. That delta value is later used to put more weight on the answers of whose interviewee provided estimation from a wider range.

Table 21: *Data processing example step 1: Data compilation*

	CONTACTS						
VALUE FEATURE	**A**	**B**	**C**	**D**	**E**	**n**	
Reliability	5	4	7	10	4	5	
Energy efficiency	10	3		9	7	4	
Running costs	4	2	1		2	4	
Customization	6	6	0	8	6	5	
Storage optimization		5	9	9	5	4	
Min	4	2	0	8	2	**Average n:**	**4.40**
Max	10	6	9	10	7		
Delta	6	4	9	2	5		

In this example, all value features have received 4 or 5 answers in total and the average amount of answers per value feature is 4,40. Contact C's estimation scale has been the widest of all contacts. His/her lowest estimation value has been 0 for *customization* and highest 9 for *storage optimization*. This gives contact C a delta value of 9. Contact D's estimation scale has been the narrowest of all contacts. His/her lowest estimation value has been 8 for *customization* and the highest 10 for *reliability*. This gives contact D a delta value of 2. Other delta values are 6 for contact A, 4 for contact B and 5 for contact E.

After the first step, every interviewee's estimations for each value feature have been multiplied by these corresponding delta values. Therefore, for example, interviewee A's estimation value 4 for *running costs* has been multiplied by his/her delta value 6 to give a weighted estimation value of 24 from contact A to value feature *running costs*. This procedure has then been repeated with every answer to construct a table presenting each question's **weighted estimations**, presented below in Table 22. Each value feature's average weighted estimation is indicated as that value feature's **reference value.** These reference values are ranked to form an analyzable order of the value features which the interviewees have pointed out as the most essential ones with electric motors offerings.

Table 22: *Data processing example step 2: Reference values*

	Weighted estimations (ESTIMATION * DELTA)					Reference Value (AVG. WEIGHTED ESTIMATIONS)	RANK
VALUE FEATURE	**A**	**B**	**C**	**D**	**E**		
Reliability	30	16	63	20	20	*29.8*	3
Energy efficiency	60	12		18	35	*31.3*	2
Running costs	24	8	9		10	*12.8*	5
Customization	36	24	0	16	30	*21.2*	4
Storage optimization		20	81	18	25	*36.0*	1

If every contact would give the maximum estimation value 10 to some of the value features, that particular value feature would also hold the largest possible reference value. By calculating that **maximum reference value**, each value feature's reference value can be converted back to correspond with the original estimation scale, in this example 0 to 10. This converted value is indicated as a **weighted average** in Table 23 and it has then been used to rank the five value features to their final order. The calculation process for the maximum reference value of this example case is illustrated below. The calculation is made by first determining the maximum weighted estimation values of each contact and then calculating the average of those to find the maximum reference value.

$$MaxWE_X = Maximum\ weighted\ estimation\ value\ from\ Contact\ X = Delta_X \times EstimationMax$$

$$MaxWE_A = Delta_A \times EstimationMax = 6 \times 10 = 60$$

$$\downarrow$$

$$MaxWE_B = 4 \times 10 = 40$$

$$MaxWE_C = 9 \times 10 = 90$$

$$MaxWE_D = 2 \times 10 = 20$$

$$MaxWE_E = 5 \times 10 = 50$$

$$MaxRef = \frac{\sum MaxWE}{n} = \frac{60 + 40 + 90 + 20 + 50}{5} = 52$$

As presented above, the maximum reference value of any value feature in this example is 52.0.

Table 23: *Data processing example step 3: Ranked order*

VALUE FEATURE	n	Reference value	Weighted average (Reference value / 52 * 10)	Rank
Storage optimization	4	36.0	6.92	1
Energy efficiency	4	31.3	6.01	2
Reliability	5	29.8	5.73	3
Customization	5	21.2	4.08	4
Running costs	4	12.8	2.45	5

The last step of the process could have been to filter out the value features which received considerably fewer answers compared to other value features. This would be done to enhance the accuracy of the results and erase the calculation deviations caused by lower amounts of answers. In the example, the average amount of answers per question was 4.40 and every value feature received at least 4 answers so this filtering process can be passed.

In this example, a conclusion can be made that the value feature *Storage optimization* has been the most important electric motor value for the interviewees. Its reference value 36.0 can be scale converted to 6.92/10. The least important value feature for the interviewees has been *Running costs* which reference value is 12.8 or 2.45/10. The final results are also illustrated below in Figure 8.

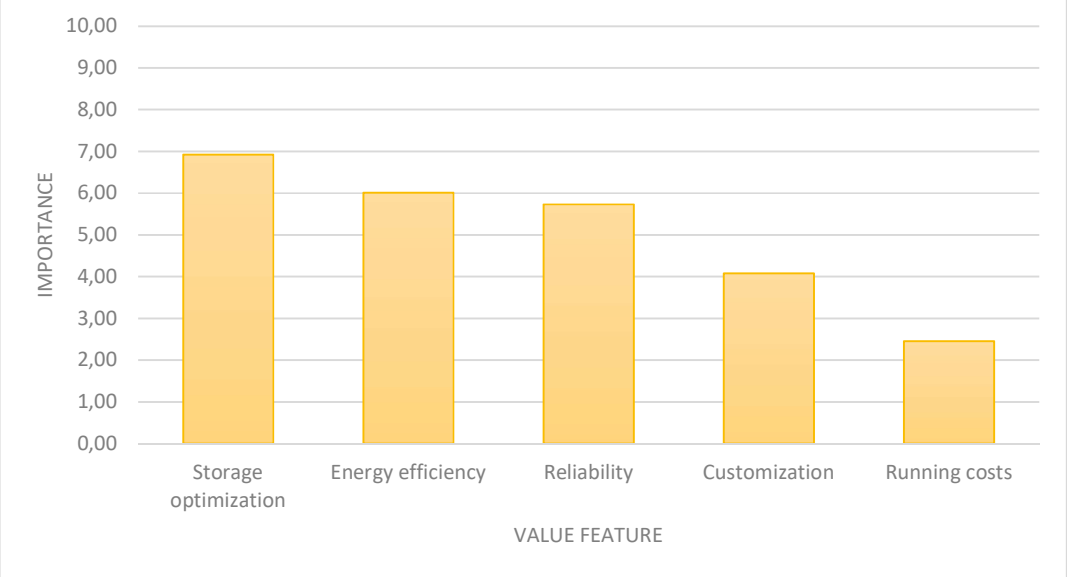

Figure 8: *Data processing example step 4: Value features in the final order*

Since the data collection of this study was divided into external and internal collection processes, the presented processing method was conducted towards both the external and the internal answer groups. Due to its weighting mechanism which acts more accurately on the most-important end of the ranking system, this method did not act as accurately on the lower, not-important end of the scale, as it did on the higher-end. This was taken into account during the research planning and it did not affect the results of this study since the AMS concept was defined specifically through the most important value features gathered from external and internal sources.

Consistencies between the pre-decision drivers and barriers and the actualized effects of industrial servitization were analyzed by comparing correlations between the following thematic frameworks:

Identified drivers ↔ Actualized positive effects
Identified barriers ↔ Actualized negative effect or problems

Identified drivers and barriers with corresponding actualized effects were validated as industrial servitization decision influencers that actually had some practical evidence to support their relevance.

3.5 Defining the asset management service concept

The top five value features indicated by the external and internal source groups were selected to form the final AMS concept definition. 5 was selected as the number of value features per source group to create a solid system of 10 separate value features that could still be effectively combined. This was supplemented with the additional inputs that interviewees had provided along with the panel interviews. This overall method was planned and validated together and by the Case Company.

The target was to identify value features with some similarities from 10 selected value features and to combine and build a distinctive definition of an AMS with core features that would fulfill expectations and generate values that both the customers and the Case Company seeks. During the research process, it was noted that the most important panel interview information and additional inputs could be distinctly compiled into three core customer values and three core supplier values. These core values and the justification behind them were also described.

4. RESULTS

In this chapter, the results of the empirical study are presented. The results have been combined from data gathered from earlier literature and the empirical study. The results are presented objectively in a form which they have been gathered. Further analyzation and discussion are presented in the next chapter.

4.1 Influencers and effects of servitization decisions

As was noticed from the earlier literature, the range of motivators that industrial manufacturers have on concentrating their resources towards servitization strategy decisions and service-orienteering their business models is wide. However, since all manufacturers have not yet taken these actions and the conversation around the topic is ongoing, it was clear from the beginning of this study that industrial service-orienteering also includes some identified risks or challenges that act as barriers against the servitization decisions. During the study, the amount of these negative servitization barriers proved to actually outnumber the positive drivers. In addition to the earlier literature, this study aimed to identify the drivers and barriers also through the empirical study. Since especially the number of identified barriers proved to be significantly wide, this study also aimed to validate the gained results by pointing out the drivers and barriers which could be connected to some actual positive or negative effects of industrial servitization, identified in earlier literature. This bilateral approach produced a group of industrial servitization drivers and barriers that have also been identified as actual effects after the service-oriented strategy decisions had been conducted (chapter 4.2).

4.1.1 Drivers and identified positive effects of industrial servitization

When data from the earlier literature, the empirical study and from the Case Company were gathered, 29 separate drivers of industrial servitization in total were identified. A more detailed description of the used data sources is listed next.

- **Five earlier studies** presented in the chapter 2.2.1 (Mont 2002; Baines et al. 2007; di Serio et al. 2017; Correa 2018; Doni et al. 2019)
- **Two Case Company's interviewees' opinions** on the considerable benefits created by an asset management service, presented in the chapter 4.4.1
- **Case Company's driving factors** towards industrial service business development presented in chapter 3.2

The 29 separate drivers were thematically categorized and eventually 9 separate thematic groups of industrial servitization drivers were formed. The following Table 24 presents these groups and points out the sources which had mentioned drivers from the thematic driver groups.

Table 24: *Thematical frame for pre-decision drivers of industrial servitization*

Thematic group of drivers	Literature	Empirical study	Case Company
Strengthening customer relationships and customer retention, substitution avoidance	X	X	
Increased service sales, profit margins and revenue	X	X	
Releasing customer from ownership related capital and resource requirements	X		X
Maintaining a more constant and predictable flow of revenues	X		X
Simplifying order, delivery and asset management processes		X	X
Increasing value generation through customization and quality improvements	X		
Easier to differentiate compared to products	X		
Increasing competitiveness through improved environmental performance	X		
Easing life-cycle management		X	

The key drivers for industrial manufacturers to invest towards service development were deepened customer relationships and increased customer retention, financial benefits through increased service sales and more constant and predictable flow of revenues, overall process simplification and the possibility to offer assets for the customers without ownership related requirements. All of these drivers were identified through 2 out of 3 used sources. Earlier literature had also identified customization and quality improvements as key value creators and improved environmental performance factors as competitiveness generators. Besides these, differentiation and life-cycle management were seen to be easier with service offerings compared to product offerings.

When the results are analyzed, the drivers can be roughly divided into three different motive categories: strengthening customer relationships, increasing financial

effectiveness and simplifying different processes. When these categories are looked from a broader perspective, apart from servitization, they all can be seen as general targets for the operative strategies of any company. Therefore, companies seek the same benefits from service orienteering than they do from other strategic decisions. That indicates that servitization is a step in the general industrial business development and not a special component or something that would create new and unseen effects.

After drivers, the focus was turned towards the identified positive effects which industrial manufacturers had provably gained from servitization decisions. The amount of these identified positive effects from 4 different sources (Lindahl et al. 2014; di Serio et al. 2017; Bressanelli et al. 2018) was 8. Due to the modest total amount and clear definitions, the positive effects were not thematically categorized any further than the earlier literature had already identified them. The identified positive effects of industrial servitization are presented in Table 25.

Table 25: *Identified positive after-implementation effects of industrial servitization decisions from earlier literature*

Strengthened customer relationships
Familiarized operating performance, conditions and most replaced components of assets
Lengthened leasability years of assets leading to longer revenue generation phases
Motivated development of durable assets with long lifetimes and low maintenance costs due to the provider's responsibility for maintenance, repairs, etc.
Increased service sales to maintain more constant and predictable revenue flows
Increased customer loyalty through repetitive purchases
New revenue streams through optimized value chains.
Enabled customer treatment and component lifetime expectancy analyses through IoT systems

Customer relationships and increased service revenues were visibly on display also as actualized servitization effects. Actualized positive effects were also found to be partly non-anticipated. For example, value chain optimization had not been an expected result, but it had actualized during a research towards a use-oriented product-service-system

of heavy trucks (di Serio et al. 2017). The actualized positive effects are analyzed more thoroughly in chapter 4.2 together with the corresponding drivers.

4.1.2 Barriers and identified negative effects of industrial servitization

Compared to the drivers of industrial servitization, a similar categorization process was conducted towards the barriers and preventers. When data from the earlier literature and the empirical study were gathered, 37 separate barriers were identified. A more detailed description of the used data sources for barriers is listed below.

- **Four earlier studies** presented in the chapter 2.2.2 (Kuo et al. 2010; Kurak et al. 2013; Barquet et al. 2013; Petrulaityte et al. 2017)
- **Five Case Company interviewee's opinions** presented in the chapter 4.4.1

As with the drivers, the 37 separate barriers were thematically categorized and eventually 10 separate thematic groups of industrial servitization barriers were formed. The following Table 26 presents these groups and points whether they were mentioned in either earlier literature or gathered from the empirical study or identified by sources.

Table 26: *Thematical frame for pre-decision barriers of industrial servitization*

Thematic group of barriers/challenges	Literature	Empirical study
Planning, developing and maintaining the service business	X	X
Implementation resource requirements, training	X	X
Logistics, storage, recycling	X	X
Increased tied-up capital of the supplier		X
Urgent customer needs for spare assets or maintenance		X
Lack of market acceptance, customer concerns	X	
Customer's requirement to commit to a single supplier		X
Lack of internal acceptance	X	
Pricing	X	
Laws and regulations	X	

Planning, developing and maintaining service business, other implementation-related requirements and logistics, storage and recycling were identified as industrial servitization barriers in both earlier literature and the empirical study. Empirical study also identified customer's tied-up capital, urgent asset needs and commitment to a single supplier as possible barriers of industrial service-based business strategies. On the

literature side, lack of internal acceptance, pricing problems and preventive laws and regulations were identified as barriers.

On the contrary to the positive effects, negative effects had been studied from industry-specific as well as from a more general aspect. Since neither of the groups contained results directly for electric motors or similar process-running assets, all results were combined to a single list. After combining, 30 negative effects or actualized problems of industrial servitization in total had been identified from 9 sources (Oliva & Kallenberg 2003; Baines et al. 2007; Valtakoski 2007; Neely 2008; Baines et al., 2009a; Kurak et al. 2013; Lindahl et al. 2014; Benedittini et al. 2015; Bressanelli et al. 2018).

These 30 identified negative effects were thematically compiled into 18 negative effect themes and were then further categorized into *financial, organizational* and *offering related problems*. In any case, however, all of the negative effects will eventually lead to problems with running a profitable business and thereby affect financial effectiveness. The final categorization is presented in Table 27.

Table 27: *Identified negative after-implementation effects of industrial servitization decisions from earlier literature*

Organizational problems:
Failures with business model redesign
Resource consuming organizational shifts
Failure to manage large organizations of service personnel
Inefficient internal knowledge diffusion
Lack of internal integrative capabilities
Marketing problems between service and customer networks
Failures to replicate HR functions and knowledge management for service network
Failures in creation of a global service infrastructure capable of local responding
Failure with required mindset shift of design, marketing, sales or customers
Offering related problems:
Problems related to ownerless consumption, such as unwillingness to pay and customer's decreased status
Solution fails to meet expectations which has led to customer rejection
Failures to understand customer values and generating them
Functionality issues
Problems in balancing between transferability and customization
Financial problems:
Pricing failures
High implementation costs
Reduced demand due to increased reusability possibilities
Increased internal bankruptcy risk of manufacturers

Identified direct financial problems created by service-orienteered strategy decisions were related to pricing, costs of implementation, reduced demand and increased bankruptcy risks. Actualized organizational problems mainly included business model redesign issues, different required organizational shifts and overall organizational management challenges, marketing problems and lack of internal acceptance. Offering related problems as the last barrier category included problems related to ownerless consumption, functionality issues and failures to meet expectations and understand customer values.

If the identified negative effects are observed from a chronological perspective, relations among these 3 categories can also be identified. On the majority of the cases, organizational problems and flaws had acted as primary causes for offering related challenges and had eventually led to financial failures. Problems with organizational

reformation required by the servitization strategy implementation had caused companies to fail in different processes, such as business model redesign, management of large service personnel and service network knowledge, creation of global service infrastructures and shifting internal mindsets towards design, marketing, sales or customers. All of the organizational challenges can be distinguished to reflect directly to the development of service offerings in which stage problems related to i.e. customer value comprehension, balancing between different offering features, meeting customers' expectations and coping with ownerless consumption had emerged. The evolutionary development of this "3 steps to servitization failure" is presented in Figure 9.

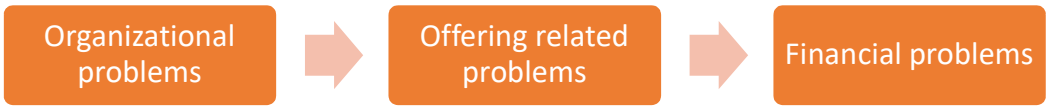

Figure 9: *Development of financial problems caused by servitization decisions*

When the offerings had not met the set targets and purposes, financial problems had eventually emerged. Since customer value generators and actual competitive advantages had not been identified or fulfilled due to earlier problems with the strategy transition itself, the market had not provided the demand that the reformed business models would have required. This had actualized as high strategy implementation costs and pricing failures, reduced demand and even increased bankruptcy risks. A more thorough analysis of the actualized negative effects is presented in chapter 4.2 together with the corresponding barriers.

4.2 Correlating influencers and identified actual effects

This chapter concentrates on the identified correlations between the effects that servitization has created for industrial manufacturers and the expectations which have either driven or prevented companies to make the required strategical decision and move towards service-oriented business models. This analysis was conducted to produce a bilateral compaction of the thematic effect categories which have been both predicted before the servitization decisions and then also identified to actualize after the decisions in earlier literature.

As was already noted from the numbers of industrial servitization drivers (29) and barriers (37), earlier literature has emphasized negative aspects over the positive ones. This was even more clearly notable when the observation was turned towards the actualized effects of servitization decisions. The amount of identified positive effects from 4 different sources (Lindahl et al. 2014; di Serio et al. 2017; Bressanelli et al. 2018) was 8, whereas 9 different sources (Oliva & Kallenberg 2003; Baines et al. 2007; Valtakoski 2007; Neely 2008; Baines et al. 2009a; Kurak et al. 2013; Lindahl et al. 2014; Benedittini et al. 2015; Bressanelli et al. 2018) provided 30 separate negative effects in total.

Next, consistency between the pre-decision drivers/barriers and the actualized positive/negative effects of servitization was analyzed. Drivers and corresponding thematic positive effect groups are first presented in Table 28.

Table 28: *Acknowledged servitization drivers and their corresponding positive effects*

Identified drivers	Corresponding actualized positive effects
Strengthening customer relationships and customer retention, substitution avoidance	**Strengthened customer relationships** **Increased customer loyalty through repetitive purchases**
Increased service sales, profit margins and revenues	**Increased service sales to maintain more constant and predictable revenue flows** **Longer revenue generation phases created by lengthened leasability years of assets**
Releasing customer from ownership related capital and resource requirements	**Provider's responsibilities of maintenance, repairs, etc. motivate the development of durable assets with long lifetimes and low maintenance costs**
Increasing value generation through quality improvements	
Maintaining a more constant and predictable flow of revenues	**New revenue streams through optimized value chains.** **Increased service sales to maintain more constant and predictable revenue flows**
Simplifying order, delivery and asset management processes	**Enabled customer treatment and component lifetime expectancy analyses through IoT systems** **Familiarized operating performance, conditions and most replaced components of assets**
Corresponding actualized effects from earlier literature, not identified as drivers: Differentiation compared to products Increasing value generation through customization	

Servitization drivers and the positive effects that industrial servitization has created were found to contain a lot of resemblances since the only identified drivers that had not actualized according to the earlier literature were *easier differentiation compared to products* and *increasing value generation through customization*. Both of these drivers are closely connected to the idea that modification of service offerings is easier and more

flexible than with traditional products, but it has to be taken into account that current suppliers who provide customers only with product offerings have also had to increase the customization and modification properties for example by creating modules from which the assets can be constructed. These kinds of offering models are well established especially by suppliers like Komatsu and Caterpillar, who produce large machinery, such as excavators or diggers.

The core driving forces guiding manufacturing companies to transform their business models towards service-based asset offerings compose mainly of the benefits which the consolidated customer relationships create. Customer retention and successful substitution avoidance lead to an increase in constant service sales which also stabilizes and levels the supplier's cash flow. Detailed and carefully designed service contracts between suppliers and customers simplify i.e. order, delivery and asset management processes which enables more resources to be focused on the customer service and service development interfaces. This combined with the rapid digitalization development like IoT and IIoT has resulted in better component lifetime expectancy analyses and has familiarized industrial assets and their operative functions to the customers. It can even be perceived that industrial servitization has in some cases enhanced the technical knowledge of customers as they, together with the suppliers, have had more resources to concentrate towards the functions of the assets.

As for all companies towards which earlier literature has concentrated, the purpose of existence for every industrial company in a capitalistic market environment is to generate profits for its owners, regardless of whether the company's stocks are listed privately or publicly. Therefore, every driver of every strategic decision, whether towards servitization or something else, includes financial motivators at some level. All in all, it was made clear during this study that drivers of industrial servitization correspond on a reasonable level with the actual effects they produce. This information can further be refined to state that the current hype and eagerness around industrial servitization is not a "bubble" since it has been proven to actually produce the positive consequences which it is used to reach.

Thematic barrier groups and the corresponding thematic negative effect groups are presented in Table 29.

Table 29: *Acknowledged servitization barriers and their corresponding negative effects*

Acknowledged barriers	Corresponding negative effects
Planning, developing and maintaining the service business	**Failures with business model redesign** **Failure to manage large organizations of service personnel** **Inefficient internal knowledge diffusion** **Failures to understand and generate customer values** **Problems in balancing between transferability and customization** **Functionality issues** **Increased internal bankruptcy risk of manufacturers** **Reduced demand due to increased reusability possibilities**
Increased tied-up capital of the supplier	**Problems related to ownerless consumption, such as unwillingness to pay and customer's decreased status level.**
Lack of market acceptance, customer concerns	**Failure with required mindset shift of customers** **Solution fails to meet expectations which leads to customer rejection**
Implementation resource requirements, training	**High implementation costs** **Lack of internal integrative capabilities** **Resource consuming organizational shifts** **Failures to replicate HR functions and knowledge management for service network** **Failures in creation of a global service infrastructure capable of local responding** **Marketing problems between service and customer networks**
Lack of internal acceptance	**Failures with required mindset shifts of design, marketing or sales**
Pricing	**Pricing failures**
Corresponding actualized effects from earlier literature, not identified as barriers: Urgent customer needs for spare assets or maintenance Customer's requirement to commit to a single supplier Logistics, storage, recycling Laws and regulations	

Servitization barriers and the negative effects that industrial servitization decisions have created regardless of preparative processes were found to contain resemblance, such as their positive counterparts. The core problems and risks with corresponding identified negative effects are tightly connected to preplanning and developing processes of the upcoming strategy update which has caused failures with e.g. business model design and organizational processes. Supplier's tied-up asset capital was also noted as a major barrier since it has created problems with the ownerless consumption of the

customer as well as major growth in the supplier's balance sheet value. Therefore, the importance of some 3rd party holding the ownership of the assets can be highly underlined.

Barriers to which corresponding negative effects were not identified included *urgent customer needs for spare assets or maintenance, customer's requirement to commit to a single supplier, laws & regulations* and *logistics, storage and recycling.* Urgent customer needs and the mandatory commitment to a single supplier were both brought up through the empirical study's internal Case Company contacts and since no proven negative effects were discovered to correspond with them, instead of actual barriers they might act more as threats or factors with still unsolved effects. Laws and regulations preventing the implementation of service-based strategies were mentioned in the literature but could not be identified as actualized challenges. When the ongoing supportive global consensus towards service development and service business in general is taken into account, finding rational justifications for preventive laws and regulations is challenging. When the acknowledged positive effects presented earlier are considered, regulatory decisions preventing industrial servitization would be harmful to the performance of manufacturing industrial companies. In countries like Finland, where the combined annual export value of all industrial sectors covers the majority of the country's total exports, the significance of industrial development can be seen as crucial for the overall financial development of the country. To elucidate, Finland's annual export composition in 2018 is presented in Table 30.

Table 30: *Finland's exports by product category in 2018 (Statistics Finland 2019)*

Industry	Export value (MEUR)	%
Forest industry products	13 094	20.6
Chemistry industry products	12 328	19.4
Metal and metal products	9 884	15.5
Machinery and equipment	8 219	12.9
Electric and electronics industry products	7 417	11.6
Other	12 740	20.0
Total	**63 682**	**100.00**

From the table, it can be seen that industries in which service-based development has been noted (forest, chemistry, metal, machinery, and electric) produced 80.0 % of Finland's total exports in 2018. This strongly supports the earlier argument about industrial service development's key role in the overall national success.

4.3 Asset management service features

This chapter presents the gathered results related to the asset management service features with the most significant customer and supplier value creation potentials. Data regarding the most valued features for the proposable AMS for electric motors was gathered via external and internal panel interviews with numerical value feature grading and verbal questions. To enhance the quality and reliability and to minimize the deviations on individual estimation habits, the numerical estimations from the two interviewee groups were processed with the processing method described in chapter 3.4. In addition to the numerical results, verbal answers received from both interviewee groups are also presented.

4.3.1 Customer value generators

External panel interview results are presented in Table 31 below. The reference values have been formed with the processing method described in chapter 3.4. The table presents the original number of each value feature on the external interview frame, the value feature itself, reference values generated by the processing method described in chapter 3.4 and each value feature's reference value's rank compared to the others.

The external panel identified price and procedure pre-agreements, balance sheet value reductions and label title optimization as the central customer value generators. Transferring process reliability-related risks, motor power increases and supplier's active role as an asset update planner were identified as the least important features. From a broader perspective, the external panel emphasized financial and optimization-related features over detailed technical aspects.

Table 31: *External panel interview results on the most valuable AMS features*

#	Value feature for the asset management service customers	Reference value	n	Rank
14	Agreeing with prices and procedures in advance	8,25	8	1
1	Possibility to decrease balance sheet value by transferring ownership of the asset base to some other party	7,86	7	2
5	Optimizing usage and storage label titles	7,75	8	3
6	Optimizing the number of storied electric motors	7,25	8	4
15	Straightforwarding the order-delivery process (orders under one contract)	6,75	8	5
17	Transferring the asset base related risks to the service supplier	6,29	7	6
19	Decreasing/terminating the storage space requirements	6,25	8	7
3	Combining the AMS with the Case Company's other maintenance services	6,00	7	8
8	Increasing energy efficiency through asset base modernization	5,88	8	9
2	AMS provided specifically by the Case Company	5,71	7	10
11	Improving the maintenance indicators	5,25	8	11
12	The Case Company taking part in planning of the asset updates/changes etc. as the AMS supplier	5,25	8	11
9	Electric motor power increases through asset base modernization	4,50	8	13
18	Transferring the process-reliability-related risks to the AMS supplier	4,38	8	14

As described in chapter 3.4, filtering was conducted towards the value features which received one or more fewer answers compared to the highest answer amount per value feature. The average amount of external answers per value feature was 6.00. This information has been used to filter out the value features which received 3 or fewer answers. By doing this, the following value features were excluded from the results. Reference values are also presented with the number of answers.

- ***Standardizing the asset base with the Case Company*** *12.00 (3 answers)*
- ***Simplifying procurement operations*** *12.00 (1 answer)*
- ***Modernizing the electric motor asset base*** *9.00 (1 answer)*
- ***Improving maintenance performance*** *6.00 (1 answer)*
- ***Risk management*** *0.00 (0 answers)*

The five most important customer value features that were taken into further consideration on the concept definition were agreeing with prices and procedures in advance, possibility to decrease balance sheet value by transferring ownership of the asset base to some other party, optimizing usage and storage label titles, optimizing the amount of storage motors and straightforwarding the order-delivery process with orders under one contract. All of these value features presented in Table 32 received a weighted average over 3.15 / 4.

Table 32: *AMS value features with the highest customer estimation averages*

VALUE FEATURE FOR ASSET MANAGEMENT SERVICE CUSTOMERS	Ref. value	Weighted average
Agreeing prices and procedures in advance	8,25	**3.88 / 4.00**
Possibility to decrease balance sheet value by transferring ownership of the asset base to some other party	7,86	**3.70 / 4.00**
Optimizing usage and storage label titles	7,75	**3.65 / 4.00**
Optimizing the number of storied motors	7,25	**3.41 / 4.00**
Straightforwarding the order-delivery process (orders under one contract)	6,75	**3.18 / 4.00**

The external contacts were also asked to point out value features that the interview frame did not include. As additional input, two external interviewees answered by pointing out the additional value feature possibilities presented below and contact A1 gave additional feature estimations also presented below.

- *Simplifying order and billing processes* (Contact B1)
- *Asset's life-cycle management and preparing for replacements in advance* (C2)
- *Maintenance services for ATEX certified motors by an authorized service operator* (ATEX = Explosive Atmosphere Environment, B1)

Additional estimations provided by contact A1 (*Lead Buyer*, Forest industry):

Digital procurement channels	*4*
Storage visibility	*4*
Decreased delivery times	*4*

To identify the core features including the maximum customer value potential, the most emphasized customer value features could be brought together and compiled into three core values:

1. **Decreasing customers' balance sheet value of own equity**
2. **Optimizing customers' label titles and the number of storied motors**
3. **Simplifying and expediting supplier-customer actions and processes**

Decreasing the balance sheet value by transferring asset ownership away from the customer was found as one of the main principles of industrial servitization in general. Moving from product-based to service-based business models and offering new usage options releases customer's resources to other objectives and as this also moves asset-

related risks away from the customer, it opens possibilities for suppliers to increase the margins from the service offerings. For the definition of the asset management service concept, this clearly indicates and points out the need for an external ownership holder party.

Optimizing label titles and the amount of storied motors also refers to the additional mention of storage visibility provided by contact A1. It indicates that an asset management service should contain the potential for a thorough asset pool analysis which could be used to decrease the number of different asset types. This would further optimize all storage functions and eventually cut storage costs.

The value of simplifying and decreasing the time consumption requirements of all processes was clearly seen on the external panel interview data and the additional inputs. Pricing, procurement, order-delivery, lifecycle planning, and billing processes were all mentioned as anticipated AMS features.

4.3.2 Supplier value generators

Internal query results are presented in Table 33 below. The reference values have been formed with the processing method described in chapter 3.4. The table presents the original number of each value feature on the internal interview frame, the value feature itself, reference values generated by the processing method described in chapter 3.4 and each value feature's reference value's rank compared to the others.

The internal panel identified deep partnership, service's and its supplier's uniqueness and different profiling factors as the most notable supplier value generators. Take-back agreements, EBIT increases through already existing offerings and brand value increases were identified as the least important features. Finding different profiling factors among the most important features while brand value factors ended among the least important ones is a matter worth noticing. It could be explained by the size and amount of different market areas of the Case Company itself and the AMS's limited ability to affect the whole company's brand and image while still making difference in the narrower market area of electric motors. From a broader perspective, the internal panel emphasized immaterial and indefinite benefits over more detailed AMS features.

Table 33: *Internal panel interview results on the most valuable AMS features*

#	Value feature for the asset management service supplier	Reference value	n	Rank
8	**Reliability and comprehensive partnership**	**12,40**	5	**1**
7	**Service uniqueness, the Case Company acting as the only provider of the AMS**	**11,50**	4	**2**
6	**Profiling as the market forerunner/pioneer**	**11,40**	5	**3**
1	**Increasing EBIT/revenue through the AMS**	**11,20**	5	**4**
3	**Being the primary and only preferred service provider (agreed through contract terms)**	**10,80**	5	**5**
9	**Transferring process-related risks to the Case Company**	**10,00**	5	**6**
5	**Positive brand value effects for the Case Company**	**8,60**	5	**7**
2	**Increasing revenue/EBIT through other already existing products and services (condition monitoring, maintenance, etc.)**	**8,40**	5	**8**
4	**Take-back agreements for the storage capital**	**4,60**	5	**9**

Since all supplier value features received 4 or 5 estimations, no value features were filtered out of the observation scope. The average amount of internal answers per value feature was 4.89. The five most important customer value features that were taken into further consideration on the concept definition were reliability and comprehensive partnership, service uniqueness, profiling as the market forerunner/pioneer, increasing revenue/EBIT straight through the AMS and being the primary and only preferred service provider (agreed through contract terms). As with external interviews, all of these value features presented in Table 34 received a weighted average over 3.15 / 4.

Table 34: *AMS value features with the highest supplier estimation averages*

VALUE FEATURE FOR ASSET MANAGEMENT SERVICE SUPPLIERS	Ref. value	Weighted average
Reliability and comprehensive partnership	12,40	**3.65 / 4.00**
Service uniqueness, asset management service provider acting as the only provider	11,50	**3.38 / 4.00**
Profiling as the market forerunner/pioneer	11,40	**3.35 / 4.00**
Increasing revenue/EBIT through the asset management service	11,20	**3.29 / 4.00**
Being the primary and only preferred service provider (agreed through contract terms)	10,80	**3.18 / 4.00**

The internal contacts were also asked to point out value features that the interview frame did not include. As additional input, four external interviewees answered by pointing out the additional value feature possibilities presented below.

- *Customer loyalty and deeper collaboration to help with other processes also* (Contacts A, D & E)
- *Increasing and easing sales and marketing processes for electric motors and services* (Contacts A & B)
- *Increasing customer satisfaction through fast response times* (Contact B)

To identify the core features holding the maximum customer value potential, most emphasized customer value features could be brought together and compiled into three core values:

1. **Reliability and overall trust partnership between supplier and customers**
2. **Profiling supplier as a market forerunner with a unique service offering**
3. **Creating new revenue channels and increasing EBIT**

Reliability and overall partnership were identified as key supplier and customer values. From the supplier's side, customer retention and strengthening the position as the preferred supplier of also other products and services are intrinsically goals that would be targeted with strengthened customer relationships. Deeper collaboration was also seen as an enabler to help with other processes related to supplier-customer relationships.

The value of features related to enhancing the supplier's image, brand and profiling were also clearly seen from the results. A unique service offering was seen to enable profiling as a market forerunner and industry pioneer. Brand and image related matters are especially emphasized with large, established suppliers that mainly compete through quality and reliability instead of price or bidding. During the panel interviews and conversations with Case Company's sales manager, it came clear that the customer base of quality and reliability driven suppliers also mainly consist of customer companies with similar strategic business-driving decisions.

Finally, the primary target for an AMS as for all strategic decisions for the supplier is to develop profit generation abilities. Case Company pointed new revenue channels and consequently EBIT (*earnings before interest and taxes*) improvements as the driving reasons for new frontline service offering generation.

4.4 Asset management service concept

After the most valued customer and supplier features were discovered, the actual AMS concept could be defined. Six core features in total, presented next, were found to contain the maximum overall value generative abilities.

Decreasing customers' balance sheet value of own equity
Optimizing customers' label titles and the number of storied motors
Simplifying and expediting supplier-customer actions and processes

Reliability and overall trust partnership between supplier and customers
Supplier's profiling as a market forerunner with a unique service offering
Creating new revenue channels and increasing supplier's EBIT

The definition for the asset management service concept was created in form of a statement consisting of AMS features that would contribute to the fulfillment of these core features.

External 3rd party owner

Decreasing the balance sheet values of both the customers and the supplier came up through multiple value features noted in this study. From the customers' side, the possibility to decrease the balance sheet value by transferring ownership of the asset base to some other party was the second most important among all customer value features. It would also release customers' free resources to other functions and overall business development instead of tying capital to the electric motors themselves. From the supplier's side, keeping the balance sheet free of customers' electric motor base value is essential due to multiple financial reasons. Maintaining ownership of the assets after they are moved to the usage of the customers would tie the supplier's own capital away from profit-generating functions, such as other investments. Increased equity would therefore impair supplier's possibilities for revenue and EBIT increases through the concept of asset management service, which was noted among the most important supplier value features.

These factors make the usage of a 3rd party asset ownership holder highly suggestible. Different financier possibilities range from the supplier's or customers' subsidiaries to small private investment companies and further to large banks and financial management institutes. The final selection should take 3rd party's profit return demand, actual saved costs, and 3rd party's widescale reliability into account. Bringing an individual 3rd party into the business model will complexify the overall business as different responsibilities, such as logistics, storage or take-back-agreements, must be agreed between all parties. On the other hand, a service triad consisting of supplier, customer and a 3rd party owner would hold potential for increased reliability and overall partnership especially between supplier and customer, if carefully planned and

conducted. Therefore, it can be pointed out that the usage of an external 3rd party asset owner would also have a positive impact on the most important supplier value feature noted from the panel interview study.

Asset label and storage optimization

Optimizing the numbers of usage and storage label titles and the number of storied motors were both noted among the most important customer value features of an electric motor asset management service. Optimizing usage and storage titles indicate the effect which would occur after all electric motors of the customer's site were provided by a single supplier. It would decrease the total amount of different motors requiring different maintenance and condition monitoring needs and would therefore decrease the amount of those mandatory resource requirements. Customer's asset base standardization was not included in the five most important customer value features, but it would also be resulted by the optimization of usage and storage label titles. Optimizing the number of storied motors through concentrated asset supply and inventory turnover monitoring would have the potential for decreasing both the storage costs and the required storage spaces. When fewer motors would be located in the storages just waiting for usage, more motors and motor-related resources could be utilized to other functions.

Based on the findings presented above, it can be stated that the optimization of asset labels and storage would have positive effects on also other important value features. With one motor supplier instead of multiple suppliers and multiple motor types with multiple contracts, i.e. pricing and life-cycle planning processes would considerably simplify as well as order-delivery processes which would be notably straight forwarded. A more thorough analysis would require a complete asset management service business model from which the effects of different storage and logistics responsibility options could be studied and compared.

Simple pricing model and a straightforward order-delivery process

Agreed and comprehensible pricing model of the electric motor asset management service came up as the most important customer value feature of the AMS concept under definition. Strong customer acceptance towards the pricing model together with a straightforward order-delivery process would also lower the bar for increasing revenues from other service offerings. Reasonable pricing model, on the other hand, could assist suppliers to create and get AMS contract clauses agreements that would prevent customers from using services from other suppliers. This would lead to the supplier acting as the only preferred service provider which was noted as one of the most

important supplier values. This would further support the development of supplier's image as a market forerunner, create a unique service with one preferred supplier, maintain reliability and comprehensive partnership, strengthen customer relationships, support the supplier's own market position and increase supplier's EBIT generation; features that were all noted among the most important value features of an AMS offering.

5. DISCUSSION

In this chapter, discussion and reflecting are conducted towards the results of the empirical study. A preferable action plan for the Case Company is presented along with the answers for this study's research questions 1 and 2.

Research question 1:
What factors drive or prevent industrial manufacturers to transform their business models towards servitized solution offerings?

Research question 2:
As part of a business model used to servitize industrial electric motors, what features should an asset management service concept include in order to create maximum customer and supplier value?

5.1 Industrial servitization drivers and barriers

Drivers and barriers of industrial servitization were studied through actualized positive and negative effects and are presented in Table 28 and 29. During the research process, it became clear that earlier research has been more concentrated on the negative effects, barriers and risks compared to the possibilities and positive effects. That was anticipated at the beginning of the research process since industrial servitization, such as IoT, IIoT and industrial digitalization, are all reasonably recently emerged fields of study with a minor data amount of actualized positive effects. That might also explain why especially larger sized manufacturing companies have been more or less conservative towards service-based asset business models. At the same time, it has to be bared in mind that large manufacturers supply large customers also and the required mindset change of the customer base is as essential as the one on the supplier's own end.

During the study, the categorization of actualized problems and negative effects came up multiple times. What was not found from the used earlier literature were the causal connections between these problem categories. As presented in Figure 9, the eventual financial problems caused by servitization decisions, such as high implementation costs or reduced demand, were themselves caused by problems related to the created

product-service-system offerings. Offerings had, for example, failed to meet customer expectations and contained functionality issues (Valtakoski 2007) or brought problems related to ownerless consumption (Baines et al. 2007). These offering related problems were further noted to be caused by organizational problems which could therefore be seen as the most important stage of preparation and the main cause for later problems. For example, business model redesign (Neely 2008), lack of different internal capabilities and marketing problems had been found from earlier research and they can easily be seen as problems on organizational levels.

As was compiled in chapter 2.2.1, the main driving factor categories were increasing generated customer value through differentiation possibilities, tightening customer relationships through more frequent interactions and maintaining and increasing revenue streams through increased sales. During the research, differentiation was in fact not identified from any actualized positive effects but tightened customer relationships as well as maintaining and increasing revenue streams were highly on display also on the side of real identified effects. What comes to the *service paradox* phenomenon that earlier literature highly emphasized, the supporting results from the research towards it were quite scarce. The only clearly contradictory finding was that the lack of market acceptance had been an actual effect of servitization even though strengthened customer relationships were proven to have taken place on multiple other cases. However, that finding can also be used to point out the significance of preparation and multidimensional organizational planning that service strategy implementations require.

Regarding the first research question, it can be stated that the target was met since 6 drivers and 6 barriers with real actualized counterparts were found and brought up. Actualized drivers consisted of improved customer relationships, increased service profits, giving customers the opportunity to yield from the asset-ownership-related requirements, increased value generation, more constant and predictable flow of revenues, and simplified order, delivery and asset management processes. Actualized barriers consisted of organizational problems, such as strategy reformation failures and inefficient internal knowledge diffuse, offering-related problems, such as failures to generate real customer value and failing to meet customer expectations, and financial problems, such as high implementation costs and eventually increased supplier bankruptcy risks.

5.2 Asset management service as part of a service business model

The concept for an electric motor asset management service was defined by identifying the most valuable service features for both the customers and suppliers and constructing a defining statement based on those. The research was conducted via panel interviews directed to both external customer company contacts for customer value data and the Case Company's internal contacts for supplier value data. Earlier literature did not provide primary information regarding the valuation of different asset management service features, but it was used to identify some plausible positive and negative features and to support the construction process of the interview frames.

Regarding the second research question about valuable features of an asset management service used as part of an electric motor manufacturer's servitization strategy transformation, the features that should be included were identified with a reasonable level of detail. To simplify the outcome, the features were collated into three core feature categories. The first one, a simple pricing model and a straightforward order-delivery process, aims to create strong customer acceptance towards the new asset management offering from the beginning. That would further help the supplier to promote contract clauses preventing the customer from utilizing services from other suppliers. This would lead to the supplier's role as an only preferable service provider and other factors that were highly valued from the Case Company's point of view. This would further support the supplier's image and brand development and eventually EBIT increase.

The second core feature category consists solely of usage of a 3rd party ownership holder. Decreasing the balance sheet value was proved to be an essential feature for both the supplier and the customers and external asset owners were also used in the literature to illustrate the reconfiguration of business models derived from the servitization strategy decisions (Di Serio et al. 2017). The question of the most effective or the most reasonable option for this role was not addressed in this study and is a topic for future research. The options that this study briefly addressed were banks and financial management institutes, subsidiaries, internal financing units of the supplier and private investment companies.

The third core feature category concentrated on the different optimization processes related to asset labels and asset storage. Basically, no earlier literature had studied these effects of any industrial asset management service. However, it was identified through the empirical research that asset label and storage optimization through a single service supplier, and therefore also asset supplier, would have positive effects on other highly valued asset management service features also. These would include enhancing pricing and life-cycle planning processes as well as decreasing storage costs and required storage spaces.

5.3 Action plan

A suggested action plan for the Case Company to continue the conceptualization process of an electric motor asset management service is presented in Figure 10. The action plan is based on the earlier literature, empirical study results and the conclusions based on those and presented in the earlier chapter 5.2.

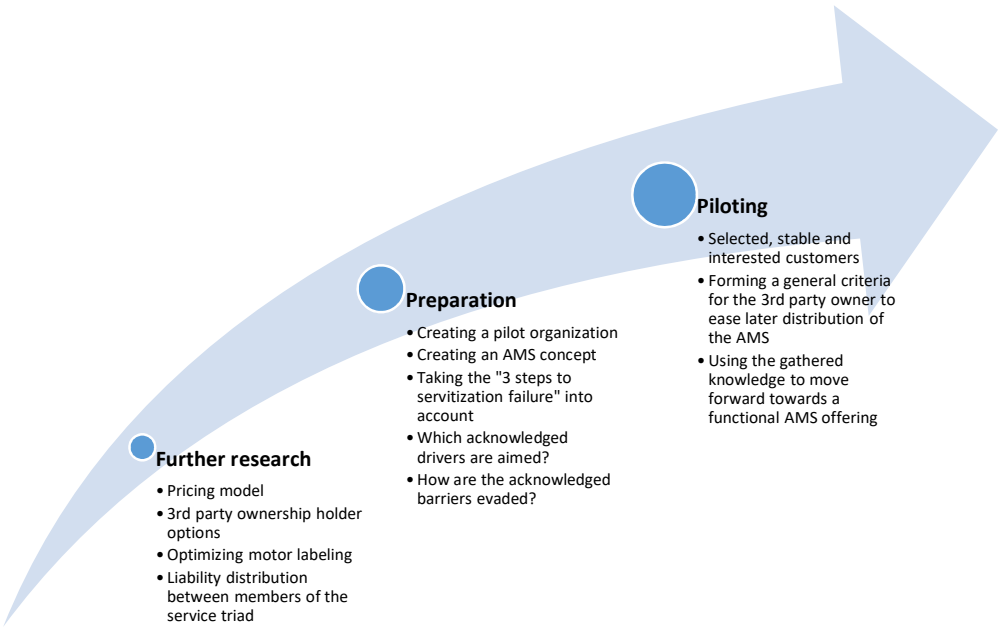

Figure 10: *Action plan for the Case Company*

The action plan divides the suggested next steps into three phases: further research before any concrete actions, preparation for the asset management service piloting and the first pilot of the new service offering.

Due to the limited amount of research results offered by this single study, further research is mandatory to continue the AMS conceptualization process. Topics that this study has revealed and that it suggests include at least the creation of a simple, customer-accepted pricing model, examination of different options to act as a 3rd party ownership holder, liability distribution (logistics, warranties, storage, etc.) between the service triad members and internal motor label optimizing possibilities. It is likely that further research will also reveal other topics to be taken into consideration before moving on towards an actual offering.

Another reason why further research can be considered as highly valuable are the "3 steps to servitization failure" that were identified during the research and that are presented in Figure 9. To prevent the eventual financial consequences, the Case Company should take the first step, organizational challenges, into account and under careful and thorough planning. To highlight the importance, the organizational identified problems are presented below in Table 35.

Table 35: *Organizational problems identified during service-orienteering strategy reformations*

Failures with the business model redesign
Resource consuming organizational shifts
Failure to manage large organizations of service personnel
Inefficient internal knowledge diffusion
Lack of internal integrative capabilities
Marketing problems between service and customer networks
Failures to replicate HR functions and knowledge management for service network
Failures in the creation of a global service infrastructure capable of local responding
Failure with required mindset shift of design, marketing, sales or customers

Since this research clearly indicated organizational issues to concretize as financial problems, the Case Company should steer further research as well as time and organizational resources towards this preplanning process.

The preparation phase's main target should be the creation of a foundation for the following piloting phase. This phase's primary targets would be to create the first actual concept of the asset management service offering and to build a pilot organization around it. The main questions driving this process should be "Which acknowledged drivers are we targeting?" and "How will we evade the acknowledged barriers, problems and challenges?" Before the actual pilot project is started, careful concentration towards the 3-step model should once again take place and the offering concept should be

observed also from different secondary organizational perspectives, such as resource allocation, support functions, HR and marketing.

The last phase of the action plan would be the first pilot project. Since the piloted service with a 3rd party ownership holder would not have been tested before, the piloting should be started with stable, long-term customers who know the Case Company and also preferably the actual personnel running the AMS. The pilot itself should be started with a minor amount of motors and to escape a situation in which the customer's site would include new motors through the AMS and older motors through a traditional business model, a portion of a greenfield site's electric motor base could be seen as an optimal starting environment. Another key factor towards a successful pilot would be frequent, transparent communication between the whole service triad. To make face-to-face meetings and site visitations easier, finding the pilot 3rd party owner as well as the pilot customer relatively close by from the Case Company's operational center should be considered. After all, only the pilot project itself might and would provide the first factual information regarding the requirements, challenges and possibilities of an asset management service for electric motors.

6. CONCLUSIONS

This chapter concludes the results of this thesis. The academic and managerial contributions are presented, and the research and its limitations are evaluated. Finally, future research needs are reviewed.

6.1 Academic contribution

This study's academic contribution is mainly based on the empirical study and the validated drivers and barriers of electric motor servitization decisions. Industrial asset management services are currently utilized in other industrial sectors but not with industrial electric motors, according to the reviewed literature. The discovered "3 steps to servitization failure" effect was also not presented in the earlier literature and that linkage between organizational problems causing offering-related issues which eventually lead to financial challenges can be regarded as a new stepping stone for further research.

This study identified benefits or improvements in customer relationships, service sales and profits, value generative abilities, revenue flows, and process simplification to act as drivers for industrial companies to consider service-oriented offering development. Considering barriers and challenges, service business administration, amount of supplier's capital, market acceptance, strategy implementation, and internal acceptance were factors that were found to contain risks that had actualized in earlier servitization strategy implementation processes. Releasing both the supplier and the customer from ownership related requirements, such as increased balance sheet values, was noted in earlier literature but not as distinctly as in this study considering electric motors.

This study also brought up the amount of different resources that a successful servitization strategy implementation requires. That process takes time, capital and workforce away from other functions of the organization and these implementation procedures were found to not have been widely studied. To conclude, the earlier literature of the subject was either totally concentrated on one specific type of assets or very vaguely addressing general phenomena around the subject of industrial servitization.

6.2 Managerial contribution

This study's managerial contribution to the Case Company is based on the asset management service concept definition and the action plan and resources that the strategy reformation requires. Simple pricing model and a straightforward order-delivery process, a 3rd party ownership holder and asset label and storage optimization as the concept's defining core features were found to advance all of the identified most important supplier and customer value features. From the supplier's side, these features included reliability and comprehensive partnership, uniqueness of the asset management service, different profiling and branding factors, EBIT development and acting as the only preferable service provider. From the customers' side, these value features included price and procedure pre-agreements, balance sheet value decrease, optimizing storage amounts as well as usage and storage label titles and straightforwarding the order-delivery process.

This study clearly brought up the amount of different resources that a successful servitization strategy implementation process requires. It takes considerable amounts of time, capital and work power away from other functions of the organization and just as with all other strategic reformation processes, that has to be accepted right from the start. It is highly unlikely that financial benefits would quickly occur since the creation of an operational service organization and network is a multi-phased project. For that project, this thesis presented an action plan which suggested further research as the first phase towards a functional service concept. Creation of a simple, customer-accepted pricing model, examination of different 3rd party ownership holder options, liability distribution between the service triad members and internal motor label optimizing possibilities were mentioned as highly suggestable research topics.

The main target of the action plan's next phase would be the creation of a foundation for the upcoming piloting phase. Primary targets would be the creation of the first actual concept of the asset management service offering and building of a pilot organization. During this phase, questions regarding the targeted main drivers and evading the acknowledged barriers should also be answered. A pilot project was the last phase of the suggested action plan and it included identifying the most suitable and stable pilot customer companies and forming general criteria for the 3rd party owner based on the research findings from future studies. Along with the action plan, it would be crucial to learn from mistakes and utilize gathered information to validate different procedures and

methods. In an ideal case, the outcome of the action plan would be further utilized towards a functioning widescale electric motor asset management service business.

6.3 Evaluation of the research

For overall evaluation and success estimation, limitations and criticism towards this research are presented next. Certain limitations do apply towards the drivers and barriers found in this study as well as towards the concept definition for an asset management service. Starting with the drivers and barriers with corresponding real industrial servitization decision effects, it has to be taken into account that for some driver or barrier to exist, it does not mean that they would have been mentioned in earlier literature. This study aimed to block this effect by also using the drivers and barriers provided by the panel interviewees but some existing industrial servitization drivers and barriers were for sure not referenced. Earlier literature data covering servitization of specifically electric motors was also not found.

Regarding the asset management service concept definition, some critique can be applied towards the amount and selection method of the external customer companies and the methods of data gathering and processing. Sample of 8 external and 5 internal contacts was quite wide since it covered 6 customer industries and 6 internal responsibility industries, but a larger sample size could have erased the possibility of result distortions and the need for feature filtering. Another considerable aspect would have been to interview contacts also from external customer companies that were not already established customers of the Case Company in some business areas. Due to data collection through interviews, absolutely objective data collection was practically impossible. The answers of individual interviewees are always at least slightly pre-oriented to one way or another and that could and was not taken into consideration during the data collection or data processing stages. The processing method with weighted reference values was also created specifically for this study and it has no real reliability evidence from earlier literature. Another interview round could have also been used to validate the identified supplier and customer features with the highest value generative potentials. Regarding the required resources of the suggested action plan, it is acknowledged that they are on a high level from the Case Company's point of view.

Regardless of the possibility of slight optimism bias due to the writer's personal working history with the subject of electric motor service business, answers for both research questions were found and the overall output level of this study can be regarded

as successful. Results regarding industrial servitization drivers and barriers were clear and up to expectations with no major conflicts between this study and earlier research. Core features for further development of an asset management service for electric motors were also defined and presented.

6.4 Future research

As mentioned in the action plan, further research is a requirement for the asset management service development process to proceed. Research topics that this study briefly addressed and suggested to be studied further are presented next.

An adequate AMS pricing model does not yet exist and its nature as customer acceptable and simple was clearly brought up in this study. Evaluating different options and creating a criteria frame for the 3rd party asset ownership holder would be essential after the pilot phase when the AMS offering would be more widely implemented and ownership holders would be based on different geographical locations. Optimizing labeling of electric motors would be required to support decreasing the amount of different AMS electric motor types at customers' sites. Last, liability distribution between members of the service triad would be absolutely important in an early phase to tackle the imminent risk and responsibility problems with for example logistics, storage, maintenance and after-life-cycle ownership of the electric motors.

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APPENDIX A: INTERVIEW FRAME FOR EXTERNAL CONTACTS

Estimation scale:

0 = Meaningless (Minor)

4 = Significant (Major)

#	Value Feature for the customer	Potential Estimation
1	Possibility to decrease balance sheet value by transferring ownership of the asset base to some other party	
2	Asset management service provided specifically by the Case Company	
3	Combining the asset management service with the Case Company's other maintenance services	
4	Standardizing the asset base with the Case Company	
5	Optimizing usage and storage label titles	
6	Optimizing the number of storied electric motors	
7	Modernizing the electric motor asset base	
8	Increasing energy efficiency through asset base modernization	
9	Electric motor power increases through asset base modernization	
10	Improving maintenance performance	
11	Improving maintenance indicators	
12	The Case Company taking part in planning of the asset updates/changes etc. as the asset management service supplier	
13	Simplifying procurement operations	
14	Agreeing with prices and procedures in advance	
15	Straightforwarding the order-delivery process (orders under one contract)	
16	Risk management	
17	Transferring the asset base related risks to the service supplier	
18	Transferring the process-reliability-related risks to the asset management service supplier	
19	Decreasing/terminating the storage space requirements	
Other possible benefits created by an asset management service? Please describe.		

APPENDIX B: INTERVIEW FRAME FOR INTERNAL CONTACTS

1. What added value would an asset management service for electric motors (possibly using external ownership party) provide for the Case Company from a perspective of electric motor manufacturer/supplier?

2. What would you consider as the biggest disadvantages/risks of an asset management service described in question 1:
    a. From the Case Company's perspective?
    b. From the customer's perspective?

Estimation scale:

0 = Meaningless (Minor)

4 = Significant (Major)

#	Value Feature for the Case Company	Potential Estimation
INCREASING EBIT / REVENUE:		
1	Through the asset management service	
2	Through other already existing products and services (condition monitoring, maintenance etc.)	
LOCKING IN CUSTOMERS:		
3	Being the primary and only preferred service provider (agreed through contract terms)	
4	Take-back agreements for the storage asset capital	
POSITIONING AS A MARKET FORERUNNER:		
5	Positive brand value effects for the Case Company	
6	Profiling as the market forerunner/pioneer	
BLOCKING COMPETITORS:		
7	Service uniqueness, the Case Company acting as the only provider of the asset management service	
DEEPENING CUSTOMER RELATIONSHIPS:		
8	Reliability and comprehensive partnership	
9	Transferring process-related risks to the Case Company	
Other possibilities / aspects? Please describe.		